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Article 1.

NYT

France Votes Its Discontents

Editorial

April 23, 2012 -- The first-round vote in the French presidential election produced a curious bi-directional backlash — from the left against the policies of austerity and from the right against immigration. The final round, which will be held on May 6, is likely to be important for all of Europe.

Sunday's vote produced two front-runners: François Hollande, the Socialist Party challenger who received more than 28 percent of the vote; and President Nicolas Sarkozy, who got about 27 percent. Since neither got a majority, they will face each other in a runoff.

The shocking result was the strong third-place finish of Marine Le Pen of the xenophobic National Front, with about 18 percent. The radical anti-immigrant right whose support Mr. Sarkozy has been shamelessly (and largely unsuccessfully) wooing for months is now a stronger and more unpredictable political force than ever.

A second-round victory by Mr. Hollande would signal a major change in fiscal direction for France and, by extension, for the entire 17-nation euro zone. A cautious moderate on most issues, and certainly not a socialist in the historic meaning of that term, Mr. Hollande, nevertheless, recognizes that the German-inspired austerity policies Mr. Sarkozy favors are not succeeding.

Instead, he would channel the government's taxing and spending power to promote faster economic growth and recovery as a surer route to long-term fiscal balance. With austerity's disastrous results sparking discontent in a growing number of European countries, a Hollande victory could signal a continental turning point.

Mr. Sarkozy, the first incumbent in half a century to be bested in the initial vote, now faces an uphill fight for re-election. To win next month, he will have to attract most of the votes cast for Ms. Le Pen and the seven other eliminated candidates. They range from the far left to the moderate center, and current polls show

most far-left voters switching to Mr. Hollande in the runoff, with centrists closely divided.

That leaves National Front voters, not all of whom are natural Sarkozy supporters. Many are anti-Europe, anti-elitist and contemptuous of Mr. Sarkozy's bling-bling style. Most also loathe Mr. Hollande. But that may not translate to support for Mr. Sarkozy in the runoff, but he has little chance of winning without a substantial share of those votes.

He needs to court them more responsibly than he has to date, invoking policy arguments, not the offensive stereotypes of his campaigns against facial veils, halal meat and Muslim street prayer. Those low-road forays did him little good on Sunday, nor did they enhance his dignity. Mr. Sarkozy owes his people a less divisive campaign.

Article 2.

The Atlantic Monthly

Are the Limits of American Power Closer Than We Think?

Max Fisher

Apr 23 2012 -- It's getting tougher for the U.S. to impose its will, but we can still lead the world -- the trick is convincing the world to follow. Here are a few of the big, global problems that

the U.S. has recently tried and failed to resolve:

- North Korea's recent test-launch of a long-range missile, which U.S. diplomacy and threats couldn't deter.
- A new war between the Sudans, breaking a short-lived peace that the U.S. spent years building.
- Syria's continuing massacre of civilians, for which neither American diplomats nor American generals can find an acceptable solution.
- Egypt's tightening military rule, which has gotten so bad that the U.S. spent weeks just to extricate some detained American NGO workers.
- Israel's settlement growth in Palestinian territory, which the U.S. opposes as a barrier to Middle East peace.
- The Yemeni president's refusal to abdicate power, despite a U.S.-brokered pledge that he would step down.
- Afghanistan's unceasing war with itself, to which ten years of American-led war have not brought peace.
- Iran's nuclear development, which looks to be continuing despite U.S. sanctions and recent U.S.-led disarmament talks.

The U.S. isn't powerless. It's significantly alleviated most of these conflicts, and it's taken the international lead on all of them. But the pattern is unmissable. It is a big, complicated world in which the U.S. can only do so much. We're the most powerful country in the world by far, but that doesn't always

make us the bosses. This might seem obvious, but American domestic discourse -- not to mention foreign discourses -- often seem to assume a strength of American hegemony that just doesn't exist.

President Obama's major foreign policy addresses, like those of the presidents before him, take American dominance in world affairs as both necessary and absolute. There's nothing wrong with declaring that Iran will not be allowed to build a nuclear weapon or that democracy will come to the Middle East. And there's nothing wrong with the American leader discussing those issues from an American perspective. After all, the U.S. is the strongest and richest country in the world, which also makes it the best positioned to help. But there's a difference between helping and solving, just as there's a difference between offering leadership and having others follow. We seem to assume the latter (as do many non-Americans, for example in Egypt, where it's common to assume "foreign hands" guide Egyptian politics when in fact the U.S. seems to have less influence there every day), imagining American power extends far beyond its actual limits.

Part of this is domestic politics. Mitt Romney was probably making a smart political move to jump on Obama's hot mic comments to Russian President Dmitri Medvedev about how the U.S. couldn't make another nuclear arms reduction deal until after the election. Reducing American might is politically unpopular (even though we don't actually need those thousands of nuclear warheads) as is the idea of offering concessions to another, not-so-friendly country. It would be bad politics for Obama to enter tough and maybe even painful negotiations with a competing nation, probably because this conflicts with the Reagan-era idea that America's inherent

strength and goodness means that we dictate terms to the world. But even Reagan compromised and horse-traded with Moscow, though he also had the good sense not to do it during an election.

This is the big conflict between how U.S. leaders negotiate American politics and American foreign policy: the former requires confidence, the latter humility. But the two are not inseparable. Maybe because our political system promotes leaders who believe most strongly in American power, or maybe because it pressures those leaders to exercise more power than they might actually have, it can often seem that the U.S. is constantly falling short of our ambitions. We can't stop Israeli settlement growth, Iranian nuclear development, Sudanese civil war, AIDS in Africa, or terrorism in Pakistan, even though American presidents keep insisting that we will. There was a time when we seemed to have more influence on how other countries behaved. In this 1980 map of Cold War alliances, the "blue" countries would reliably, if not always, follow U.S. leadership. Part of that was because we had easier requests then; it's one thing to tell Pakistani generals to train anti-Soviet fighters, quite another to ask them to give up power to democratic institutions. But the threat of Soviet domination gave us a common mission that made cooperation more attractive and American leadership more desirable. There's no more great red menace to unify the majority of the world under American leadership. Other countries don't need us in the way that they used to.

The good news is that American and global interests still tend to line up pretty frequently. That's not a coincidence. The U.S. does more than any other country at maintaining global peace, cooperation, and free trade. The rest of the world might not

depend on American protection from the Soviet Union, but it depends on the U.S.-enforced political and economic order. That's the new American leadership. When China slashed its Iranian oil imports by half -- a big blow to Tehran and a boost to the U.S.-led effort to isolate Iran -- it wasn't because Obama called up Chinese President Hu Jintao and told him to do it. The U.S., through a lot of difficult and sometimes painful diplomatic and economic maneuvering, found a way to line up American and Chinese interests.

This sort of power makes the U.S. good at promoting democracy, cooperation, and free trade -- Burma's opening, for example, or China's remarkably peaceful rise -- but less effective at stopping civil wars or convincing dictators to do things that might threaten their own rules (or lives). If Iranian leaders believe they need a nuclear program to save themselves from a U.S. invasion, they're going to keep it. And the logic of ethnic conflict or religious terrorism can't really be refuted by, say, American trade incentives.

When U.S. interests line up with global interests, we suddenly become very effective at leading the world: isolating Iran, convincing Sudan to allow its southern third to secede, or curbing Chinese trade abuses, for example, would probably all have been impossible on our own. But they also wouldn't have happened without the U.S. taking the lead. That means that U.S. leadership is becoming more about finding opportunities for cooperation and compromise than it is about, say, the strength of our military or force of our ideas, although those help too. Sometimes the U.S. president has to tell his Russian counterpart that he'll offer some concessions in exchange for, say, dismantling Soviet-era nuclear weapons or reducing arms sales to Syria. That's not a particularly jingoistic vision of

American leadership, and it's not likely to play well in a political campaign. But that's the world we live in.

Max Fisher is an associate editor at The Atlantic, where he edits the International channel.

Article 3.

The Washington Post

The luxury we don't have in Syria

Richard Cohen

April 24 -- About a month ago the European Union, showing it will not be trifled with, barred Bashar al-Assad's wife, Asma, and other women in his immediate family from shopping for luxury goods in Europe. For some reason, going cold turkey on Dior, Armani and Prada failed to bring down the Assad regime or to end its vicious attacks on the civilian population. Now the Europeans, presumably with the staunch support of the Obama administration, have imposed an across-the-board ban on the sale of luxury goods to Syria — and yet, somehow, the killing continues.

The imposition of the luxury goods ban was cited in a New York Times editorial with all the solemnity usually reserved for naval blockades — as good an example of any of how we have gone to dreamland. In the dream, a vicious dictator, fighting for his own and his family's lives, will somehow come to the bargaining table because he is down to his last Montblanc pen. Of course, more practical measures and

boycotts have also been adopted, but it is always good to remember that severe boycotts were imposed on Saddam Hussein's regime for about 12 years — and it still took an invasion to bring him down. There is a lesson here.

With a kind of freeze-frame inevitability, the Syrian crisis unfolds in a predictable fashion. A year ago came the first rumblings of insurrection — a stirring in Daraa — and then demonstrations in the capital, Damascus, and, as expected, the violent response by the security forces. This produced a cascade of wishful thinking, with the U.S. and other Western governments saying Assad would be ousted in no time and the crisis would all go away.

It is all still with us.

An estimated 9,000 people are dead, the bulk of them civilians. Countless more have fled the country, seeking asylum or merely a gulp of water, in Jordan or Turkey. Assad, who has no legitimate claim to power, has turned his army and its guns against his people. He has shelled housing blocks and makeshift hospitals. Snipers have killed the merely curious. Journalists have been targeted and, in effect, murdered.

The standard arms embargo is being proposed. But it will have little effect. Already, the Russians are suspected of using diplomatic flights to bring in arms, and Iran, Syria's real patron, does pretty much what it wants. And what it wants most of all is for the Assad regime to prevail.

The United Nations has sent in observers, as many as 12 of them, with possibly 288 more on the way. So far, the Assad regime has played a cat-and-mouse game with them —

withdrawing tanks and troops when the observers arrive, bringing them back when they leave. Whatever the case, Assad will not allow the United Nations to stand between him and his enemies.

Syria replays Bosnia. Step by step this charade unfolds in a predictable fashion. We can see the outcome. Assad will agree to almost anything but do almost nothing. He cannot turn back. Too much blood has been spilled. Too many oaths of vengeance have been taken. The more the fighting goes on, the more radicalized both sides get. Assad's father killed perhaps 20,000 in the city of Hama. It is still a family record; it may turn out to be only a personal best.

Just as the clumsy and ineffective measures that allowed things to get out of hand in Bosnia are being repeated, so should the solution — air power. This is part of the prescription advocated by John McCain, Lindsey Graham and Joe Lieberman, senators all. They propose bombing Syrian command and control facilities as well as supplying the opposition with weapons. (So far, I've been told, not even the promised communications equipment has shown up in any appreciable number.) They also recommend establishing safe areas within Syria so that the insurgents can be properly trained and given medical help, although putting them over the Jordanian and Turkish borders might be more feasible.

It's impossible to know what would follow the Assad regime. An Islamic republic? Sectarian mayhem? But one way to avoid a disastrous outcome is for the United States to help organize the opposition and show that America is on the side of the protesters. Washington, though, has been on the sidelines, and

the Europeans lack the military to do what needs to be done. In the meantime, both the Syrian people and the Assad clan will suffer — the former deprived of life and liberty and the latter of this season's latest shoes.

Article 4.

The Daily Beast

Hamas Still Not Ready for Prime Time

Hussein Ibish

April 23, 2012 -- In a wide-ranging interview with the Jewish Daily Forward, Hamas leader Mousa Abu Marzook again demonstrated the difficult position in which his organization finds itself. Due to the Arab uprisings, the region's strategic landscape is now primarily defined by sectarian allegiances. As a result, Hamas's external leadership is trying to reintegrate the organization into the mainstream Sunni Arab fold, cultivating closer ties with states like Qatar, Jordan and Egypt, while distancing itself from Iran and abandoning Syria altogether.

The leadership in exile, including Abu Marzook, therefore finds itself at odds with much of the Gaza-based leadership, which does not have the same urgent need to find either new headquarters and patrons or a new regional brand and identity. Their rule in Gaza is uncontested. They have income from smuggling, and through efforts by Gaza-based Hamas leaders

like Mahmoud Zahar and Ismail Hanniyeh, they maintain relationships, and at least some funding from, Iran. So, they see much less need to make radical changes.

Reaching out to a major American Jewish publication to explain his thinking serves many functions for Abu Marzook. His carefully calibrated and mixed message walks the tightrope the external leadership now has to traverse: adopt positions the Arab states can tolerate; align more closely with in the policies of other Muslim Brotherhood parties, especially Egypt's; and help to create a softer image in the West and Israel, without abandoning the organization's core principles.

For many years Abu Marzook has been eclipsed by his former deputy, Khaled Mishaal. But the current crisis has produced a complex power struggle within Hamas, both inside and outside Gaza. This interview may also have been part of an effort to position himself as a compromise figure between Mishaal and more hard-line leaders.

The external leadership of Hamas knows it has to pay a price for adapting to the new regional realities, but it wishes to keep this to a minimum. Hamas leaders want to avoid being perceived by other Palestinians as adopting policies towards Israel indistinguishable in practice from the mainstream national leadership in Ramallah—especially the goal of a two-state solution. If it openly accepted that this was its strategy for national liberation, Hamas would then have to compete with Fatah largely on the basis of religious and social conservatism. But its social and religious agenda in Gaza, the most conservative part of Palestinian society, has not proved popular. If Hamas is to retain a competitive political advantage

over Fatah, it must be by outbidding them on Israel.

Abu Marzook was careful not to cede too much. He insisted that the most Hamas could accept is a long-term truce (“hudna”), but not peace, with Israel; that it would not be bound by any agreements made by the PLO (the sole legitimate representative of the Palestinian people); and that Hamas would not recognize Israel.

On this last point, he hedged in a manner indicative of the need to placate both Western and Arab governments committed to a two-state outcome, and those parts of his own constituency unalterably opposed to it. He cagily noted, “Maybe my answer right now [about recognizing Israel] is completely different to my answer after 10 years.” This can be read as leaving the door open for an evolution towards recognition of Israel, or as leaving the door open for a resumption of armed struggle and a cancellation of the truce. The Forward emphasized, “Abu Marzook was at pains to knock down suggestions... [that] Hamas is preparing to abandon armed resistance against Israel...”

Suffice it to say, the Abu Marzook interview was not reassuring. Hamas is in crisis, and it's trying to adapt. Still, even its external leaders, as they are trying to project a softer image, in fact are still clinging to a hard line that rejects the conditions laid out by the Middle East Quartet—the US, the EU, the UN and Russia—for it to be recognized as a legitimate political actor: renunciation of violence; recognition of Israel's right to exist; and acceptance of the validity of existing Israeli-Palestinian agreements.

From the point of view of the Palestinian national interest, Hamas is still part of the problem, not part of the solution. Its fundamental positions, even in theory, are strictly dysfunctional with regard to the international community. They cannot serve as the basis of serious negotiations with Israel. And they are out of sync with the consensus of the Arab world, as reflected in the Arab Peace Initiative and the policies of most Arab governments.

Abu Marzook's interview demonstrates that as far as Palestinian national leadership is concerned, Hamas is still very much not ready for prime time, and neither is he.

Article 5.

NYT

Peace Without Partners

Ami Ayalon, Orni Petruschka and Gilead Sher

April 23, 2012 -- FOR three years, attempts at negotiations between Israel and the Palestinian leadership have failed because of a lack of trust. It now seems highly unlikely that the two sides will return to negotiations — but that does not mean the status quo must be frozen in place.

Israel doesn't need to wait for a final-status deal with the Palestinians. What it needs is a radically new unilateral approach: It should set the conditions for a territorial compromise based on the principle of two states for two peoples, which is essential for Israel's future as both a Jewish and a democratic state.

Israel can and must take constructive steps to advance the reality of two states based on the 1967 borders, with land swaps — regardless of whether Palestinian leaders have agreed to accept it. Through a series of unilateral actions, gradual but tangible changes could begin to transform the situation on the ground.

Israel should first declare that it is willing to return to negotiations anytime and that it has no claims of sovereignty on areas east of the existing security barrier. It should then end all settlement construction east of the security barrier and in Arab neighborhoods of Jerusalem. And it should create a plan to help 100,000 settlers who live east of the barrier to relocate within Israel's recognized borders.

That plan would not take full effect before a peace agreement was in place. But it would allow settlers to prepare for the move and minimize economic disruption. Israel should also enact a voluntary evacuation, compensation and absorption law for settlers east of the fence, so that those who wish can begin relocating before there is an agreement with the Palestinians. According to a survey conducted by the Israeli pollster Rafi Smith, nearly 30 percent of these 100,000 settlers would prefer to accept compensation and quickly relocate within the Green Line, the pre-1967 boundary dividing Israel

from the West Bank, or to adjacent settlement blocs that would likely become part of Israel in any land-swap agreement.

Our organization, Blue White Future, holds regular meetings with settlers. We have found that many would move voluntarily if the government renounced its sovereign claims to the West Bank, because they would see no future for themselves there.

Critics will argue that unilateral moves by Israel have been failures — notably the hasty withdrawal from the Gaza Strip in 2005, which left settlers homeless and allowed Hamas to move into the vacuum and launch rockets into Israel.

But we can learn lessons from those mistakes. Under our proposal, the Israeli Army would remain in the West Bank until the conflict was officially resolved with a final-status agreement. And Israel would not physically force its citizens to leave until an agreement was reached, even though preparations would begin well before such an accord.

We don't expect the most ideologically motivated settlers to support this plan, since their visions for Israel's future differ radically from ours. But as a result of our discussions and seminars with settlers of all stripes, we believe that many of them recognize that people with different visions are no less Zionist than they are. We have learned that we must be candid about our proposed plan, discuss the settlers' concerns and above all not demonize them. They are the ones who would pay the price of being uprooted from their homes and also from their deeply felt mission of settling the land.

The Palestinian Authority has already taken constructive

unilateral steps by seeking United Nations recognition as a state and building the institutions of statehood in the West Bank. Neither action contradicted the two-state vision.

Although many Israelis and the Obama administration objected to the bid for statehood, it could have moved us closer to that outcome had Israel welcomed it rather than fought it.

After all, Israel could negotiate more easily with a state than with a nonstate entity like the Palestinian Authority. And statehood would undermine the Palestinians' argument for implementing a right of return for Palestinian refugees, since the refugees would have a state of their own to return to.

Constructive unilateralism would also be in the interest of the United States. If President Obama supported this strategy, he would simply be encouraging actions aimed at facilitating an eventual negotiated agreement based on the parameters proposed by President Bill Clinton in 2000.

We recognize that a comprehensive peace agreement is unattainable right now. We should strive, instead, to establish facts on the ground by beginning to create a two-state reality in the absence of an accord. Imperfect as it is, this plan would reduce tensions and build hope among both Israelis and Palestinians, so that they in turn would press their leaders to obtain a two-state solution.

Most important, as Israel celebrates 64 years of independence later this week, it would let us take our destiny into our own hands and act in our long-term national interest, without blaming the Palestinians for what they do or don't do.

Ami Ayalon is a former commander of the Israeli Navy and head of the Israeli domestic security agency. Orni Petruschka is an entrepreneur. Gilead Sher was a peace negotiator and chief of staff to the Israeli prime minister from 1999 to 2001.

Article 6.

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Chinese Values?

Joschka Fischer

23 April 2012 -- There can be little reasonable doubt today that the People's Republic of China will dominate the world of the twenty-first century. The country's rapid economic growth, strategic potential, huge internal market, and enormous investment in infrastructure, education, and research and development, as well as its massive military buildup, will see to that. This means that, in political and economic terms, we are entering an East and Southeast Asian century.

Lest we forget, the outcome for the world would have been far worse if China's ascent had failed. But what will this world look like? We can foresee the power that will shape its geopolitics, but what values will underlie the exercise of that power?

The official policy of "Four Modernizations" (industrial, agricultural, military, and scientific-technological) that has underpinned China's rise since the late 1970's has failed to

provide an answer to that question, because the “fifth modernization” – the emergence of democracy and the rule of law – is still missing. Indeed, political modernization faces massive opposition from the Chinese Communist Party, which has no interest in surrendering its monopoly of power. Moreover, the transition to a pluralist system that channels, rather than suppresses, political conflict would indeed be risky, though the risk will grow the longer one-party rule (and the endemic corruption that accompanies it) persists.

Ideologically, Chinese leadership’s rejection of human rights, democracy, and the rule of law is based on the contention that these supposedly universal values are a mere stalking horse for Western interests, and that repudiating them should thus be viewed as a matter of self-respect. China will never again submit to the West militarily, so it should not submit to the West normatively either.

And here we return to the concept of “Asian values,” originally developed in Singapore and Malaysia. But until this day, three decades later, its meaning remains unclear. Essentially, the concept has served to justify collectivist-authoritarian rule by aligning it with local tradition and culture, with autonomy defined in terms of otherness – that is, differentiation from the West and its values. Thus, “Asian values” are not universal norms, but rather a self-preservation strategy harnessed to identity politics.

Given the history of Western colonialism in Asia, the desire to maintain a distinct identity is both legitimate and understandable, as is the belief in many Asian countries – first and foremost China – that the time has come to settle old

scores. But the effort to preserve one's power, the need for a distinct "Asian" identity, and the desire to settle historical scores will not solve the normative question raised by China's emergence as the century's dominant power.

How that question is answered is crucially important, because it will determine the character of a global power, and thus how it deals with other, weaker countries. A state becomes a world power when its strategic significance and potential give it global reach. And, as a rule, such states then try to safeguard their interests by imposing their predominance (hegemony), which is a recipe for dangerous conflict if based on coercion rather than cooperation.

The world's acclimation to a global hegemonic structure – in which world powers guarantee an international order – survived the Cold War. The Soviet Union wasn't ideologically anti-Western, because Communism and Socialism were Western inventions, but it was anti-Western in political terms. And it failed not only for economic reasons, but also because its internal and external behavior was based on compulsion, not consent. By contrast, the United States' economic and political model, and that of the West, with its individual rights and open society, proved to be its sharpest weapon in the Cold War. The US prevailed not because of its military superiority, but because of its soft power, and because its hegemony was based not on coercion (though there was some of that, too), but largely on consent. Which path will China choose? While China will not change its ancient and admirable civilization, it owes its re-emergence to its embrace of the contemporary Western model of modernization – the huge achievement of Deng Xiaoping, who put the country on its current path more

than three decades ago. But the decisive question of political modernization remains unanswered.

Clearly, national interests, and sometimes pure power, play a part in how the US and other Western countries apply values like human rights, the rule of law, democracy, and pluralism. But these values are not mere ideological window dressing for Western interests; in fact, they are not that to any significant extent. They are indeed universal, and all the more so in an era of comprehensive globalization.

The contribution of Asia – and of China, in particular – to the development of this universal set of values is not yet foreseeable, but it will surely come if the “fifth modernization” leads to China’s political transformation. China’s course as a world power will be determined to a significant extent by the way it confronts this question.

Joschka Fischer was German Foreign Minister and Vice Chancellor from 1998-2005. Fischer entered electoral politics after participating in the anti-establishment protests of the 1960’s and 1970’s, and played a key role in the establishment of the German Green Party, which he led for nearly two decades.

Article 7.

New York Review of Books

The Crisis of Big Science

Steven Weinberg

May 10, 2012 -- Last year physicists commemorated the centennial of the discovery of the atomic nucleus. In experiments carried out in Ernest Rutherford's laboratory at Manchester in 1911, a beam of electrically charged particles from the radioactive decay of radium was directed at a thin gold foil. It was generally believed at the time that the mass of an atom was spread out evenly, like a pudding. In that case, the heavy charged particles from radium should have passed through the gold foil, with very little deflection. To Rutherford's surprise, some of these particles bounced nearly straight back from the foil, showing that they were being repelled by something small and heavy within gold atoms. Rutherford identified this as the nucleus of the atom, around which electrons revolve like planets around the sun.

This was great science, but not what one would call big science. Rutherford's experimental team consisted of one postdoc and one undergraduate. Their work was supported by a grant of just £70 from the Royal Society of London. The most expensive thing used in the experiment was the sample of radium, but Rutherford did not have to pay for it—the radium was on loan from the Austrian Academy of Sciences.

Nuclear physics soon got bigger. The electrically charged particles from radium in Rutherford's experiment did not have enough energy to penetrate the electrical repulsion of the gold nucleus and get into the nucleus itself. To break into nuclei and learn what they are, physicists in the 1930s invented cyclotrons and other machines that would accelerate charged

particles to higher energies. The late Maurice Goldhaber, former director of Brookhaven Laboratory, once reminisced:

The first to disintegrate a nucleus was Rutherford, and there is a picture of him holding the apparatus in his lap. I then always remember the later picture when one of the famous cyclotrons was built at Berkeley, and all of the people were sitting in the lap of the cyclotron.

1.

After World War II, new accelerators were built, but now with a different purpose. In observations of cosmic rays, physicists had found a few varieties of elementary particles different from any that exist in ordinary atoms. To study this new kind of matter, it was necessary to create these particles artificially in large numbers. For this physicists had to accelerate beams of ordinary particles like protons—the nuclei of hydrogen atoms—to higher energy, so that when the protons hit atoms in a stationary target their energy could be transmuted into the masses of particles of new types. It was not a matter of setting records for the highest-energy accelerators, or even of collecting more and more exotic species of particles, like orchids. The point of building these accelerators was, by creating new kinds of matter, to learn the laws of nature that govern all forms of matter. Though many physicists preferred small-scale experiments in the style of Rutherford, the logic of discovery forced physics to become big.

In 1959 I joined the Radiation Laboratory at Berkeley as a postdoc. Berkeley then had the world's most powerful accelerator, the Bevatron, which occupied the whole of a large

building in the hills above the campus. The Bevatron had been built specifically to accelerate protons to energies high enough to create antiprotons, and to no one's surprise antiprotons were created. What was surprising was that hundreds of types of new, highly unstable particles were also created. There were so many of these new types of particles that they could hardly all be elementary, and we began to doubt whether we even knew what was meant by a particle being elementary. It was all very confusing, and exciting.

After a decade of work at the Bevatron, it became clear that to make sense of what was being discovered, a new generation of higher-energy accelerators would be needed. These new accelerators would be too big to fit into a laboratory in the Berkeley hills. Many of them would also be too big as institutions to be run by any single university. But if this was a crisis for Berkeley, it wasn't a crisis for physics. New accelerators were built, at Fermilab outside Chicago, at CERN near Geneva, and at other laboratories in the US and Europe. They were too large to fit into buildings, but had now become features of the landscape. The new accelerator at Fermilab was four miles in circumference, and was accompanied by a herd of bison, grazing on the restored Illinois prairie.

By the mid-1970s the work of experimentalists at these laboratories, and of theorists using the data that were gathered, had led us to a comprehensive and now well-verified theory of particles and forces, called the Standard Model. In this theory, there are several kinds of elementary particles. There are strongly interacting quarks, which make up the protons and neutrons inside atomic nuclei as well as most of the new particles discovered in the 1950s and 1960s. There are more

weakly interacting particles called leptons, of which the prototype is the electron.

There are also “force carrier” particles that move between quarks and leptons to produce various forces. These include (1) photons, the particles of light responsible for electromagnetic forces; (2) closely related particles called W and Z bosons that are responsible for the weak nuclear forces that allow quarks or leptons of one species to change into a different species—for instance, allowing negatively charged “down quarks” to turn into positively charged “up quarks” when carbon-14 decays into nitrogen-14 (it is this gradual decay that enables carbon dating); and (3) massless gluons that produce the strong nuclear forces that hold quarks together inside protons and neutrons.

Successful as the Standard Model has been, it is clearly not the end of the story. For one thing, the masses of the quarks and leptons in this theory have so far had to be derived from experiment, rather than deduced from some fundamental principle. We have been looking at the list of these masses for decades now, feeling that we ought to understand them, but without making any sense of them. It has been as if we were trying to read an inscription in a forgotten language, like Linear A. Also, some important things are not included in the Standard Model, such as gravitation and the dark matter that astronomers tell us makes up five sixths of the matter of the universe.

So now we are waiting for results from a new accelerator at CERN that we hope will let us make the next step beyond the Standard Model. This is the Large Hadron Collider, or LHC. It

is an underground ring seventeen miles in circumference crossing the border between Switzerland and France. In it two beams of protons are accelerated in opposite directions to energies that will eventually reach 7 TeV in each beam, that is, about 7,500 times the energy in the mass of a proton. The beams are made to collide at several stations around the ring, where detectors with the mass of World War II cruisers sort out the various particles created in these collisions.

Some of the new things to be discovered at the LHC have long been expected. The part of the Standard Model that unites the weak and electromagnetic forces, presented in 1967–1968, is based on an exact symmetry between these forces. The W and Z particles that carry the weak nuclear forces and the photons that carry electromagnetic forces all appear in the equations of the theory as massless particles. But while photons really are massless, the W and Z are actually quite heavy. Therefore, it was necessary to suppose that this symmetry between the electromagnetic and weak interactions is “broken”—that is, though an exact property of the equations of the theory, it is not apparent in observed particles and forces.

The original and still the simplest theory of how the electroweak symmetry is broken, the one proposed in 1967–1968, involves four new fields that pervade the universe. A bundle of the energy of one of these fields would show up in nature as a massive, unstable, electrically neutral particle that came to be called the Higgs boson.¹ All the properties of the Higgs boson except its mass are predicted by the 1967–1968 electroweak theory, but so far the particle has not been observed. This is why the LHC is looking for the Higgs—if found, it would confirm the simplest version of the

electroweak theory. In December 2011 two groups reported hints that the Higgs boson has been created at the LHC, with a mass 133 times the mass of the proton, and signs of a Higgs boson with this mass have since then turned up in an analysis of older data from Fermilab. We will know by the end of 2012 whether the Higgs boson has really been seen.

The discovery of the Higgs boson would be a gratifying verification of present theory, but it will not point the way to a more comprehensive future theory. We can hope, as was the case with the Bevatron, that the most exciting thing to be discovered at the LHC will be something quite unexpected. Whatever it is, it's hard to see how it could take us all the way to a final theory, including gravitation. So in the next decade, physicists are probably going to ask their governments for support for whatever new and more powerful accelerator we then think will be needed.

2.

That is going to be a very hard sell. My pessimism comes partly from my experience in the 1980s and 1990s in trying to get funding for another large accelerator.

In the early 1980s the US began plans for the Superconducting Super Collider, or SSC, which would accelerate protons to 20 TeV, three times the maximum energy that will be available at the CERN Large Hadron Collider. After a decade of work, the design was completed, a site was selected in Texas, land bought, and construction begun on a tunnel and on magnets to steer the protons.

Then in 1992 the House of Representatives canceled funding

for the SSC. Funding was restored by a House–Senate conference committee, but the next year the same happened again, and this time the House would not go along with the recommendation of the conference committee. After the expenditure of almost two billion dollars and thousands of man-years, the SSC was dead.

One thing that killed the SSC was an undeserved reputation for over-spending. There was even nonsense in the press about spending on potted plants for the corridors of the administration building. Projected costs did increase, but the main reason was that, year by year, Congress never supplied sufficient funds to keep to the planned rate of spending. This stretched out the time and hence the cost to complete the project. Even so, the SSC met all technical challenges, and could have been completed for about what has been spent on the LHC, and completed a decade earlier.

Spending for the SSC had become a target for a new class of congressmen elected in 1992. They were eager to show that they could cut what they saw as Texas pork, and they didn't feel that much was at stake. The cold war was over, and discoveries at the SSC were not going to produce anything of immediate practical importance. Physicists can point to technological spin-offs from high-energy physics, ranging from synchrotron radiation to the World Wide Web. For promoting invention, big science in this sense is the technological equivalent of war, and it doesn't kill anyone. But spin-offs can't be promised in advance.

What really motivates elementary particle physicists is a sense of how the world is ordered—it is, they believe, a world

governed by simple universal principles that we are capable of discovering. But not everyone feels the importance of this. During the debate over the SSC, I was on the Larry King radio show with a congressman who opposed it. He said that he wasn't against spending on science, but that we had to set priorities. I explained that the SSC was going to help us learn the laws of nature, and I asked if that didn't deserve a high priority. I remember every word of his answer. It was "No."

What does motivate legislators is the immediate economic interests of their constituents. Big laboratories bring jobs and money into their neighborhood, so they attract the active support of legislators from that state, and apathy or hostility from many other members of Congress. Before the Texas site was chosen, a senator told me that at that time there were a hundred senators in favor of the SSC, but that once the site was chosen the number would drop to two. He wasn't far wrong. We saw several members of Congress change their stand on the SSC after their states were eliminated as possible sites.

Another problem that bedeviled the SSC was competition for funds among scientists. Working scientists in all fields generally agreed that good science would be done at the SSC, but some felt that the money would be better spent on other fields of science, such as their own. It didn't help that the SSC was opposed by the president-elect of the American Physical Society, a solid-state physicist who thought the funds for the SSC would be better used in, say, solid-state physics. I took little pleasure from the observation that none of the funds saved by canceling the SSC went to other areas of science.

All these problems will emerge again when physicists go to their governments for the next accelerator beyond the LHC. But it will be worse, because the next accelerator will probably have to be an international collaboration. We saw recently how a project to build a laboratory for the development of controlled thermonuclear power, ITER, was nearly killed by the competition between France and Japan to be the laboratory's site.

There are things that can be done in fundamental physics without building a new generation of accelerators. We will go on looking for rare processes, like an extremely slow conjectured radioactive decay of protons. There is much to do in studying the properties of neutrinos. We get some useful information from astronomers. But I do not believe that we can make significant progress without also pushing back the frontier of high energy. So in the next decade we may see the search for the laws of nature slow to a halt, not to be resumed again in our lifetimes.

Funding is a problem for all fields of science. In the past decade, the National Science Foundation has seen the fraction of grant proposals that it can fund drop from 33 percent to 23 percent. But big science has the special problem that it can't easily be scaled down. It does no good to build an accelerator tunnel that only goes halfway around the circle.

3.

Astronomy has had a very different history from physics, but it has wound up with much the same problems. Astronomy became big science early, with substantial support from

governments, because it was useful in a way that, until recently, physics was not.² Astronomy was used in the ancient world for geodesy, navigation, time-keeping, and making calendars, and in the form of astrology it was imagined to be useful for predicting the future. Governments established research institutes: the Museum of Hellenistic Alexandria; the House of Wisdom of ninth-century Baghdad; the great observatory in Samarkand built in the 1420s by Ulugh Beg; Uraniborg, Tycho Brahe's observatory, built on an island given by the king of Denmark for this purpose in 1576; the Greenwich Observatory in England; and later the US Naval Observatory.

In the nineteenth century rich private individuals began to spend generously on astronomy. The third Earl of Rosse used a huge telescope called Leviathan in his home observatory to discover that the nebulae now known as galaxies have spiral arms. In America observatories and telescopes were built carrying the names of donors such as Lick, Yerkes, and Hooker, and more recently Keck, Hobby, and Eberly.

But now astronomy faces tasks beyond the resources of individuals. We have had to send observatories into space, both to avoid the blurring of images caused by the earth's atmosphere and to observe radiation at wavelengths that cannot penetrate the atmosphere. Cosmology has been revolutionized by satellite observatories such as the Cosmic Background Explorer, the Hubble Space Telescope, and the Wilkinson Microwave Anisotropy Probe, working in tandem with advanced ground-based observatories. We now know that the present phase of the Big Bang started 13.7 billion years ago. We also have good evidence that, before that, there was a

phase of exponentially fast expansion known as inflation.

But cosmology is in danger of becoming stuck, in much the same sense as elementary particle physics has been stuck for decades. The discovery in 1998 that the expansion of the universe is now accelerating can be accommodated in various theories, but we don't have observations that would point to the right theory. The observations of microwave radiation left over from the early universe have confirmed the general idea of an early era of inflation, but do not give detailed information about the physical processes involved in the expansion. New satellite observatories will be needed, but will they be funded?

The recent history of the James Webb Space Telescope, planned as the successor to Hubble, is disturbingly reminiscent of the history of the SSC. At the funding level requested by the Obama administration last year, the project would continue, but at a level that would not allow the telescope ever to be launched into orbit. In July the House Appropriations Committee voted to cancel the Webb telescope altogether. There were complaints about cost increases, but as was the case with the SSC, most of the increase came because year by year the project was not adequately funded. Funding for the telescope has recently been restored, but the prognosis for future funding is not bright. The project is no longer under the authority of NASA's Science Mission Directorate. The technical performance of the Webb project has been excellent, and billions have already been spent, but the same was true of the SSC, and did not save it from cancellation.

Meanwhile, in the past few years funding has dropped for

astrophysics at NASA. In 2010 the National Research Council carried out a survey of opportunities for astronomy in the next ten years, setting priorities for new observatories that would be based in space. The highest priorities went first to WFIRST, an infrared survey telescope; next to Explorer, a program of mid-sized observatories similar in scale to the Wilkinson Microwave Anisotropy Probe; then to LISA, a gravitational wave observatory; and finally to an international X-ray observatory. No funds are in the budget for any of these.

Some of the slack in big science is being taken up by Europe, as for instance with the LHC and a new microwave satellite observatory named Planck. But Europe has worse financial problems than the US, and the European Union Commission is now considering the removal of large science projects from the EU budget.

Space-based astronomy has a special problem in the US. NASA, the government agency responsible for this work, has always devoted more of its resources to manned space flight, which contributes little to science. All of the space-based observatories that have contributed so much to astronomy in recent years have been unmanned. The International Space Station was sold in part as a scientific laboratory, but nothing of scientific importance has come from it. Last year a cosmic ray observatory was carried up to the Space Station (after NASA had tried to remove it from the schedule for shuttle flights), and for the first time significant science may be done on the Space Station, but astronauts will have no part in its operation, and it could have been developed more cheaply as an unmanned satellite.

The International Space Station was partly responsible for the cancellation of the SSC. Both came up for a crucial vote in Congress in 1993. Because the Space Station would be managed from Houston, both were seen as Texas projects. After promising active support for the SSC, in 1993 the Clinton administration decided that it could only support one large technological project in Texas, and it chose the Space Station. Members of Congress were hazy about the difference. At a hearing before a House committee, I heard a congressman say that he could see how the Space Station would help us to learn about the universe, but he couldn't understand that about the SSC. I could have cried. As I later wrote, the Space Station had the great advantage that it cost about ten times more than the SSC, so that NASA could spread contracts for its development over many states. Perhaps if the SSC had cost more, it would not have been canceled.

4.

Big science is in competition for government funds, not only with manned space flight, and with various programs of real science, but also with many other things that we need government to do. We don't spend enough on education to make becoming a teacher an attractive career choice for our best college graduates. Our passenger rail lines and Internet services look increasingly poor compared with what one finds in Europe and East Asia. We don't have enough patent inspectors to process new patent applications without endless delays. The overcrowding and understaffing in some of our prisons amount to cruel and unusual punishment. We have a shortage of judges, so that civil suits take years to be heard.

The Securities and Exchange Commission, moreover, doesn't have enough staff to win cases against the corporations it is charged to regulate. There aren't enough drug rehabilitation centers to treat addicts who want to be treated. We have fewer policemen and firemen than before September 11. Many people in America cannot count on adequate medical care. And so on. In fact, many of these other responsibilities of government have been treated worse in the present Congress than science. All these problems will become more severe if current legislation forces an 8 percent sequestration—or reduction, in effect—of nonmilitary spending after this year.

We had better not try to defend science by attacking spending on these other needs. We would lose, and would deserve to lose. Some years ago I found myself at dinner with a member of the Appropriations Committee of the Texas House of Representatives. I was impressed when she spoke eloquently about the need to spend money to improve higher education in Texas. What professor at a state university wouldn't want to hear that? I naively asked what new source of revenue she would propose to tap. She answered, "Oh, no, I don't want to raise taxes. We can take the money from health care." This is not a position we should be in.

It seems to me that what is really needed is not more special pleading for one or another particular public good, but for all the people who care about these things to unite in restoring higher and more progressive tax rates, especially on investment income. I am not an economist, but I talk to economists, and I gather that dollar for dollar, government spending stimulates the economy more than tax cuts. It is simply a fallacy to say that we cannot afford increased

government spending. But given the anti-tax mania that seems to be gripping the public, views like these are political poison. This is the real crisis, and not just for science.³

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1. In his recent book, *The Infinity Puzzle* (Basic Books, 2011), Frank Close points out that a mistake of mine was in part responsible for the term “Higgs boson.” In my 1967 paper on the unification of weak and electromagnetic forces, I cited 1964 work by Peter Higgs and two other sets of theorists. This was because they had all explored the mathematics of symmetry-breaking in general theories with force-carrying particles, though they did not apply it to weak and electromagnetic forces. As known since 1961, a typical consequence of theories of symmetry-breaking is the appearance of new particles, as a sort of debris. A specific particle of this general class was predicted in my 1967 paper; this is the Higgs boson now being sought at the LHC .

As to my responsibility for the name “Higgs boson,” because of a mistake in reading the dates on these three earlier papers, I thought that the earliest was the one by Higgs, so in my 1967 paper I cited Higgs first, and have done so since then. Other physicists apparently have followed my lead. But as Close points out, the earliest paper of the three I cited was actually the one by Robert Brout and François Englert. In extenuation of my mistake, I should note that Higgs and Brout and Englert did their work independently and at about the same time, as also did the third group (Gerald Guralnik, C.R. Hagen, and Tom Kibble). But the name “Higgs boson”

seems to have stuck. ←

2. I have written more about this in “The Missions of Astronomy,” *The New*

York Review , October 22, 2009. ↵

3. This article is based on the inaugural lecture in the series “On the Shoulders of Giants” of the World Science Festival in New York on June 4, 2011, and on a plenary lecture at the meeting of the American Astronomical Society in Austin on January 9, 2012.