

letters

systems in which physicists have an important role to play. As methods to produce well-controlled colloidal crystals are developed² and instrumental techniques to study their behavior under nonequilibrium conditions are refined,³ the study of the static and dynamic structures of such supramolecular assemblies offers additional opportunities to understand many-body interactions. The possibilities of translating these to interactions in molecular systems are also promising.

I hope that PHYSICS TODAY will continue to highlight these and related areas of physics, such as the series of articles on fluids out of equilibrium,⁴ in its future issues. In this context, your readers may also be interested in a forthcoming symposium⁵ on the statistical mechanics of micellar and micro-emulsion systems, scheduled for the spring 1985 meeting of the American Chemical Society.

References

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5. Symposium on Statistical Thermodynamics of Micellar and Micro-emulsion Systems, ACS, Miami Beach, 29 April-1 May 1985; Organizer: S. H. Chen, Nuclear Engineering, MIT.

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10/84

Why is there an arms race?

Your July editorial (page 128) was correct in that physicists can contribute to greater understanding of the arms-control problem. But, while the technical aspects are important, understanding the political and emotional forces involved is more important, and these influences should not be obscured by physics problems. Why is there an arms race?

All policies are mixtures of both rational and irrational decisions, foolishness and (in some cases) wisdom; but they are often more irrational, more foolish and more unconscious than they are rational, wise and conscious. There are many examples of the irrationalities that spur the arms race:

► Early man probably relied on those

close to him (who also carried his genes) for protection and support while others posed a danger. The need to belong, to be in a group, is basic. But for in-groups to exist, there must be out-groups. People need outsiders, aliens, unaccepted "others." Does anyone doubt that if Earth were invaded, the US and USSR would drop their rivalry to fight the invaders? We would become parts of the same in-group, for there would be outsiders to define it.

► People need friends, but they also need enemies—people to love and people to hate. The history of the US (or any other great state) is, in part rationally, a kaleidoscope of friends and foes. Yesterday's bitter enemy is today's close friend. The identity changes, but one thing is constant: the existence of enemies. They fill a basic human need.

► Emotions, strong emotions, are rewarding. Humans crave excitement. Which is more exciting, war or peace? Huge machines (toys) or education? The new or the old? Fighting or negotiating? Action or thought? Victory or compromise? Intricacy or simplicity?

► We react not to things but to what they represent as symbols. Why do people lose their temper if the flag is damaged? It is only a piece of cloth. But symbols have emotional content in that they summarize and substitute for things otherwise too large or too abstract for us to comprehend. So we fight for these symbols, even at the expense of that which they represent.

► Arms have emotional content—they are not only useful, but enjoyable. And they are symbols for values of great emotional content: power, pleasure, pride, patriotism, toughness, self-righteousness, moral superiority, emotional security, stability, glory, excitement. They are a form of group identification and wish fulfillment and an escape from both subtlety and complexity.

► It is common for people to develop methods to reach goals and then become so involved with these means that they not only lose sight of the end but also become so obsessed that they are happy to accept an outcome that is the complete opposite of their original goal (the means justifies the end). What is more important: national security or lots of enjoyable weapons—even if they threaten national security?

► A major reason for the current arms buildup was the Iranian hostage situation. However, more weapons would not have helped there, and the arms now being acquired are aimed not at Iran but the Soviet Union. An analysis of this explains much about arms races.

► Logically arms should be obtained for use (even if only as a deterrent) the way money should be obtained to buy things. But money is often acquired

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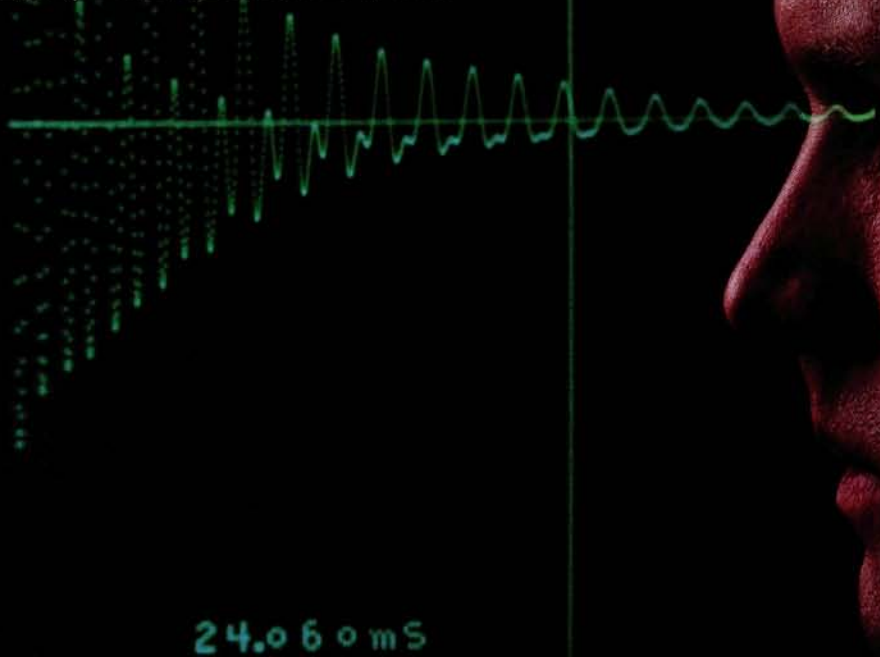
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not for the purpose of purchase but to represent its holder's success, security, prestige, power and importance. So it is with the arms race. Some of our own weapons are more of a threat to us than the USSR, and if security is the goal, they make no sense. But security is not the goal, arms are.

► As scientists we understand earthquakes, eclipses and the like in terms of natural laws. But neither primitive nor modern peoples think this way. For them, things must be personalized. Why is there an earthquake? The gods are angry. Why is there evil in the world, why are there social problems and unpleasant changes? Because of the devil, the Jews, multinational corporations, the Soviet Union. Of course there is evil in the Soviet system, and it aggravates many problems. But if everything is blamed on the USSR, what is the chance of our policies bringing us closer to peace, and what is the chance they will make things worse?

► The Russians have 984 missiles and we have only 897. We're behind! One might think that, considering the differences in the two nations' security needs and arms stockpiles, it would be impossible to judge requirements by elementary means, by simple arithmetic. But rational decisions are difficult; simple numerical comparisons are easier. What is the chance of simple arithmetic giving wise decisions? Thinking is hard, which is why we have developed so many ways to avoid it.

These are the problems facing the US, the USSR and every one of us. Human irrationalities create and define the scientific problems, which are difficult, as many scientific problems are. Our responsibility is to find the means of overcoming them, to solve the problems and to keep the human race (and the rest of the Earth's biosphere) in existence. What should be done? For a scientist the first step is obvious: strive to understand.

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10/84

Nuclear spin waves

When several of our fellow scientists read your news item entitled "Nuclear spin waves seen in dilute polarized gases" (June, page 19), they asked me something like "I thought you just observed spin waves in He^3/He^4 mixtures—why haven't they mentioned your work?" I could only reply that the news was mostly about observations in dilute, nondegenerate systems and that our work was on concentrated, degenerate solutions at temperatures far

below the Fermi temperature. However, when one considers the final paragraph or two of the report, my excuse seems somewhat lame. It is not clear why the experiments done in Jülich (Phys. Rev. Lett. 51, 2120 [1983]) were ignored, despite the clear demonstration of spin waves in the helium mixtures ("the degenerate case") and the excellent fit of the data to the appropriate theory (Platzmann and Wolff, Phys. Rev. Lett. 18, 280 [1967]). It is even less understandable when one realizes that our work should have been known to Bertram Schwarzschild; it was described by one of us in an invited talk at the same Washington APS meeting to which he refers in his report.

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10/84

Clarify the language of science

In your September editorial (page 144) you point out that to improve science education in high schools and colleges, we need to first increase public appreciation and acceptance of science.

I suggest that one of the factors that has prevented many nonscientists from pursuing an interest in science is inherent in its very language. By this I am not referring to the technical vocabulary, intimidating as that may be, but to the many common words that have been appropriated into different areas of science with highly specific meanings. Such terms constitute "paradoxical jargon" in that they are part of the specialized language of science, and yet, because of their common meanings, may not be recognized as such.¹

The possibility that multiple meanings confuse science students was mentioned in a letter by Francis Throw in your July 1983 issue (page 96), but he concluded that there is no real problem because the particular meaning is clear from context. I suggest that this is often not the case. To illustrate my point, I once overheard a college counselor trying to explain specific gravity to a first-year physics student. If the student wasn't confused after hearing about "particular" or "unambiguous" gravity, I certainly was. It is not easy to apply the concept of specific gravity without realizing that the "specific" in this case means "compared to water" and not "particular." In addition, some words have different meanings in different areas of science. "Plasma" in biology is entirely different from "plasma" in physics. Something "radical" in government has little to do with either a methyl "radical" or a square root "radical." Such multiplicity of meanings can easily result in radical

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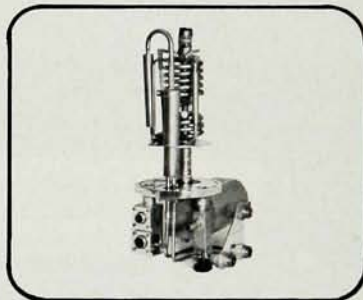
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