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The myth of Earth's stable axis

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KRb + KRb → K_2 + Rb_2 as being of great interest but also as being a significant impediment to the goal of preparing a quantum gas of oriented KRb molecules.

The cold gas that Jin and Ye have created does indeed offer a unique environment to study chemical reactions that are strongly affected by quantum mechanics. One such opportunity, not noted in their article, is the ability to manipulate reaction cross sections by "coherent control."[1] In that approach one creates an initial superposition of scattering states that allows control over reaction cross sections through quantum interference.

Two coherent control scenarios are worth examining toward the goal of controlling or reducing the KRb + KRb reactive cross section. The first was designed to control cross sections in the scattering of identical diatomic molecules, and the second is a method capable of suppressing reactive scattering by suitable preparation of the initial scattering state. Both are discussed in reference 1.

Demonstrating coherent control of collisional processes in the cold KRb gas would contribute greatly to understanding and manipulating chemical reactions on a fundamental quantum level. The use of such control to suppress the KRb + KRb reaction, if successful, would be an added technological benefit on the way to producing the desired quantum gas of oriented molecules.

Reference

1. M. Shapiro, P. Brumer, *Principles of the Quantum Control of Molecular Processes*, Wiley, New York (2003); *Quantum Control of Molecular Processes*, Wiley-VCH, Weinheim, Germany, in press.

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Johanna Miller's otherwise excellent article on the Martian icecap (PHYSICS TODAY, June 2011, page 12) was slightly marred by the opening paragraph, which repeated the myth that Earth, unlike Mars, has a stable axis because of our large moon. I'm afraid things are not that simple. The Moon does indeed have a stabilizing influence since its presence increases Earth's precession rate thus avoiding chaotic resonant interactions with the rest of the solar system.[1] However, increased tidal drag resulting from the Moon's presence slows our rotation; that slowing in turn reduces Earth's equatorial bulge and leads to slower precession and, eventually, to an unstable axis.[2] Long-term axial stability is best achieved by rapid spin (to give a large equatorial bulge) and no moon (to reduce tidal drag).

References

1. J. Laskar, F. Joutel, P. Robutel, *Nature* **361**, 615 (1993).
2. W. R. Ward, *Icarus* **50**, 444 (1982).

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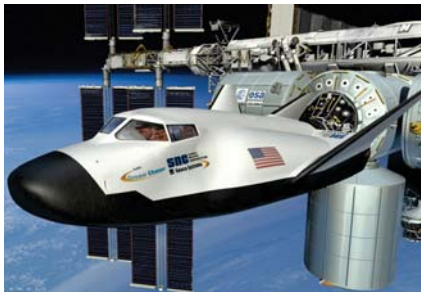
Corrections

September 2011, page 72—Harry Lustig's article, "The life and times of Werner Heisenberg," was published in the journal *Physics in Perspective*.

October 2011, page 22—The image below is the correct artist's conception of Sierra Nevada Corp's proposed



Dream Chaser craft, which would transport crew to and from the International Space Station. ■