

LEVITATING DZHANIBEKOV EFFECT ON EARTH - CLASSROOM DEMONSTRATIONS

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The Dzhanibekov effect is one of the most surprising effects of classical mechanics. It is best visible in the microgravity environment (e.g., at the International Space Station) where one can see for example a T-shaped body making surprising jumps by 180 degrees. It turns out that the rotation of a body with respect to a principal axis with an intermediate moment of inertia is not stable whereas the rotations with respect to the axes with the largest and smallest moments of inertia are stable.

This effect is rarely discussed when teaching physics at universities. One reason is that the theoretical analysis is rather complex and more importantly, it is rather difficult to nicely demonstrate this effect on Earth.

We propose classroom demonstrations of this effect using air levitation. We will show that one can levitate (1) a T-shaped metal body in a transparent sphere and (2) a styrofoam ball with properly chosen masses. In both cases, we can directly observe the Dzhanibekov effect. In the case of the styrofoam ball, students can easily change the distribution of masses and activate and deactivate the effect. In our opinion, a discussion of this effect should naturally appear when teaching rigid body dynamics.

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