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Testing Einstein's theory of gravity in a millisecond pulsar triple system ANNE ARCHIBALD, ASTRON — Einstein's theory of gravity depends on a key postulate, the strong equivalence principle. This principle says, among other things, that all objects fall the same way, even objects with strong self-gravity. Almost every metric theory of gravity other than Einstein's general relativity violates the strong equivalence principle at some level. While the weak equivalence principle — for objects with negligible self-gravity — has been tested in the laboratory, the strong equivalence principle requires astrophysical tests. Lunar laser ranging provides the best current tests by measuring whether the Earth and the Moon fall the same way in the gravitational field of the Sun. These tests are limited by the weak self-gravity of the Earth: the gravitational binding energy (over c^2) over the mass is only 4.6×10^{-10}. By contrast, for neutron stars this same ratio is expected to be roughly 0.1. Thus the recently-discovered system PSR J0337+17, a hierarchical triple consisting of a millisecond pulsar and two white dwarfs, offers the possibility of a test of the strong equivalence principle that is more sensitive by a factor of 20 to 100 than the best existing test. I will describe our observations of this system and our progress towards such a test.

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