Are pulsar glitches triggered by a superfluid two-stream instability?

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abstract Mature neutron stars are expected to have several superfluid components. Strong evidence for this is provided by the glitches that have been observed in dozens of pulsars. The underlying idea behind most glitch models is that, as the neutron star crust spins down due to the emission of electromagnetic radiation, the superfluid component lags behind until a critical point is reached and angular momentum is transferred from the superfluid to the crust, leading to the spin-up associated with the glitch. In this Letter we describe a superfluid analogue of the two-stream instability that is well known in plasma physics, and provide evidence that this instability is likely to be relevant for neutron stars. This is a new physical mechanism which may play a key role in explaining the glitch mechanism and which could also prove to be relevant in laboratory experiments on superfluid Helium.