Dark goo: Bulk viscosity as an alternative to dark energy

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We present a simple (microscopic) model in which bulk viscosity plays a role in explaining the present acceleration of the universe. The effect of bulk viscosity on the Friedmann equations is to turn the pressure into an "effective" pressure containing the bulk viscosity. For a sufficiently large bulk viscosity, the effective pressure becomes negative and could mimic a dark energy equation of state. Our microscopic model includes self-interacting spin-zero particles (for which the bulk viscosity is known) that are added to the usual energy content of the universe. We study both background equations and linear perturbations in this model. We show that a dark energy behavior is obtained for reasonable values of the two parameters of the model (i.e. the mass and coupling of the spin-zero particles) and that linear perturbations are well-behaved. There is no apparent fine tuning involved. We also discuss the conditions under which hydrodynamics holds, in particular that the spin-zero particles must be in local equilibrium today for viscous effects to be important.

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