The interior of astrophysical black holes: no singularity, just standard model physics?

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A large class of stationary, non-rotating black hole metrics is proposed, in which the interior is regular with a core consisting of a condensate of Higgs and Z bosons generated from the nuclear binding energy of the initial H atoms. Gravitational collapse is prevented by the negative pressures of the Higgs particles and a negative radial pressure due to a small imbalance in the distribution of electric charges. Non-condensed, thermal particles are present as well.

The approach holds for masses exceeding 1.5 Neptune masses or 0.000075 solar masses, hence for all astrophysical black holes. The inner horizon sets an inner core of 11 cm, while the characteristic radius of the full core is 270 $(M/M_\odot)^{1/3}$ cm. For increasing charge, the core expands; for extremal charge, it fills the interior.

While the existence of charged black hole is in doubt, the approach can likely be extended to rotating black holes. When the rotation is nearly extremal, the core may be exposed in black hole merging, so that such a black hole acts somewhat like a neutron star, be it with any mass.

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