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New light fundamental fields are natural candidates for all or a fraction of dark matter. Self-gravitating structures of such fields might be common objects in the universe, and could comprise even galactic halos. These structures would interact gravitationally with black holes, a process of the utmost importance since it dictates their lifetime, the black hole motion, and possible gravitational radiation emission. We study the dynamics of a black hole piercing through a much larger fully relativistic boson star, made of a complex minimally coupled massive scalar without self-interactions. As the black hole pierces through the bosonic structure, it is slowed down by accretion and dynamical friction, giving rise to gravitational-wave emission. Since we are interested in studying the interaction with large and heavy scalar structures, we consider mass ratios up to q ˜ 10 and length ratios L ˜ 62. Somewhat surprisingly, for all our simulations, the black hole accretes more than 95% of the boson star material, even if an initially small black hole collides with large velocity. This is a consequence of an extreme "tidal capture"process, which binds the black hole and the boson star together, for these mass ratios. We find evidence of a "gravitational atom"left behind as a product of the process.

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