Bondi accretion in the spherically symmetric Johannsen-Psaltis spacetime

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Abstract. The Johannsen–Psaltis spacetime explicitly violates the no hair theorem. It describes rotating black holes with scalar hair in the form of parametric deviations from the Kerr metric. In principle, black hole solutions in any modified theory of gravity could be written in terms of the Johannsen–Psaltis metric. We study the accretion of gas onto a static limit of this spacetime. We utilise a recently proposed pseudo–Newtonian formulation of the dynamics around arbitrary static, spherically symmetric spacetimes. We obtain a potential that generalises the Paczyński–Wiita potential to the static Johannsen–Psaltis metric. We also perform a fully relativistic analysis of the geodesic equations in the static Johannsen–Psaltis spacetime. We find that positive values of the scalar hair parameter, ϵ_3, lower the accretion rate and vice versa. Similarly, positive (negative) values of ϵ_3 reduce (increase) the gravitational acceleration of radially infalling massive particles.