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Approximation of relevant elliptical equations in the Schwarzschild metric and some astrophysical applications

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In this talk I consider the light path of observed photons emitted by matter in a *Schwarzschild gravitational field. Ray-tracing methods* are employed to tackle this problem and the used main equations are: **light bending**, **time delay** and **solid angle**. They are expressed through *elliptic integrals* that can be resolved numerically through generally complex routines. To run faster codes and to deal more easily with the applications *Beloborodov (2002)* and *Poutanen & Beloborodov (2006)* found a simple polynomial approximation to describe respectively light bending and time delay with high-accuracy for photon emitted at radius out of the event horizon ($rr_S = 2GM/c^2$). Though the results are relevant, it appears not clear how to derive them. I propose a *mathematical method* able to recover the above equations and in addition to provide an analytical approximation, for the first time, of the solid angle equation. Some applications show the power of this set of approximation equations like iron line profile and polarized light coming from an accretion disk.

Collaboration

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