Gravitational Lensing in Plasma

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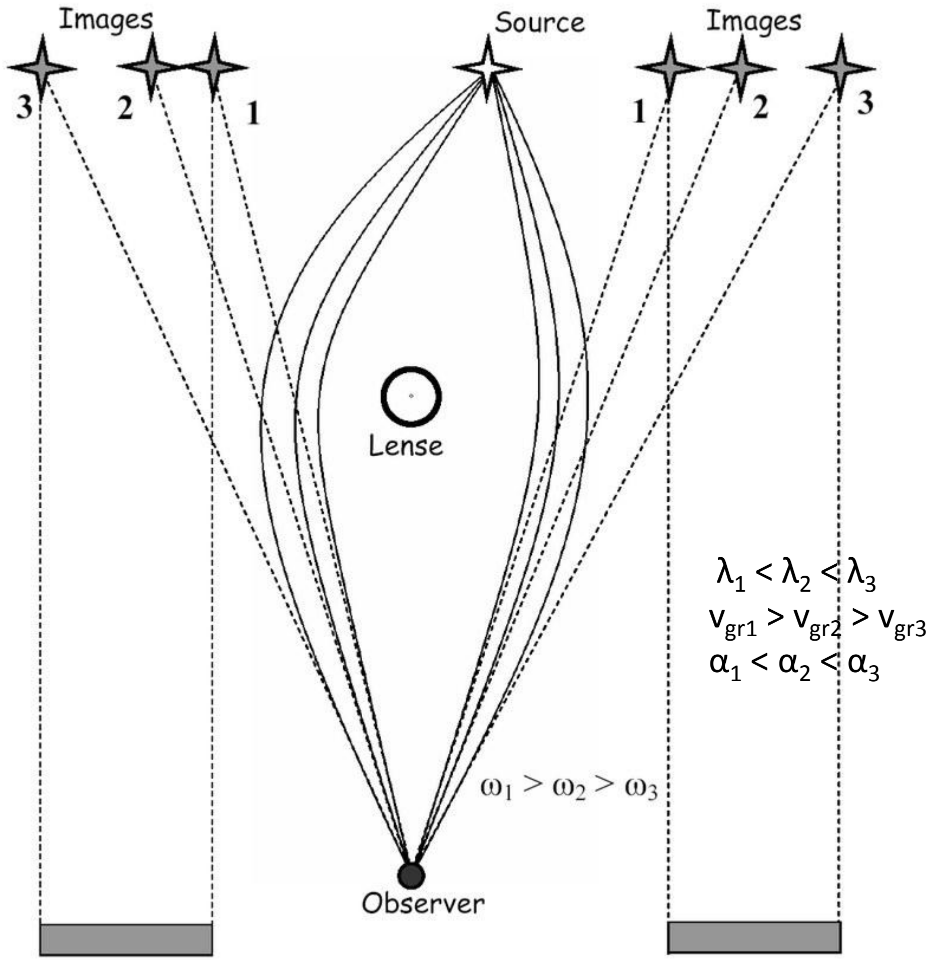
We have shown:
gravitational deflection angle in homogeneous plasma is different from vacuum deflection angle (Einstein angle), and depends on frequency of the photon.

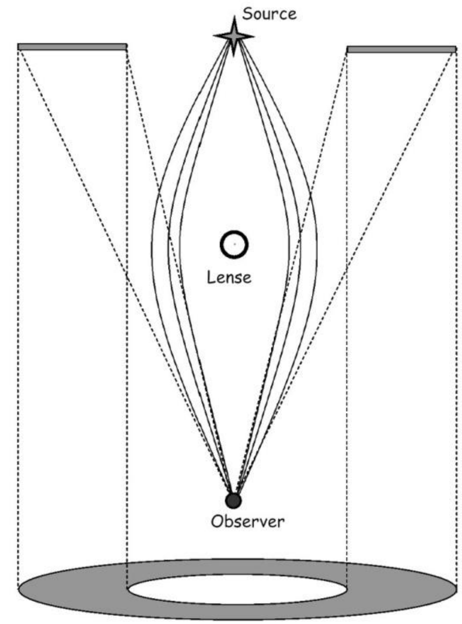
$$\hat{\alpha} = \frac{2R_S}{b} = \frac{4GM}{c^2 b} \quad \Rightarrow \quad \hat{\alpha} = \frac{R_S}{b}\left(1 + \frac{1}{1 - (\omega_e^2/\omega^2)}\right)$$

vacuum

homogeneous plasma

That resembles the properties of the refractive prism spectrometer. The strongest action of this spectrometer is for the frequencies slightly exceeding the plasma frequency, what corresponds to very long radiowaves. This effect can be called ***Gravitational Radiospectrometer***.





$$\frac{\Delta\theta_0}{\theta_0} = \frac{\theta_0^{pl} - \theta_0}{\theta_0} = \frac{1}{4}\frac{\omega_e^2}{\omega^2} \simeq 2.0 \cdot 10^7 \, \frac{N_e}{\nu^2}$$

where ν is the photon frequency in Hz, $\omega = 2\pi\nu$

Our approach allows us simultaneously consider two effects:
gravitational deflection in plasma, which is different from the vacuum case both in homogeneous and inhomogeneous plasma (new effect)
+
the non-relativistic effect (refraction) connected with the plasma inhomogeneity

Publications:

1. Bisnovatyi-Kogan G.S., Tsupko O.Yu. Gravitational radiospectrometer // Gravitation and Cosmology. 2009. V.15. N.1. P.20. arXiv:0809.1021v2
2. Bisnovatyi-Kogan G.S., Tsupko O.Yu. Gravitational lensing in a non-uniform plasma, MNRAS 404, 1790–1800 (2010). arXiv:1006.2321v1