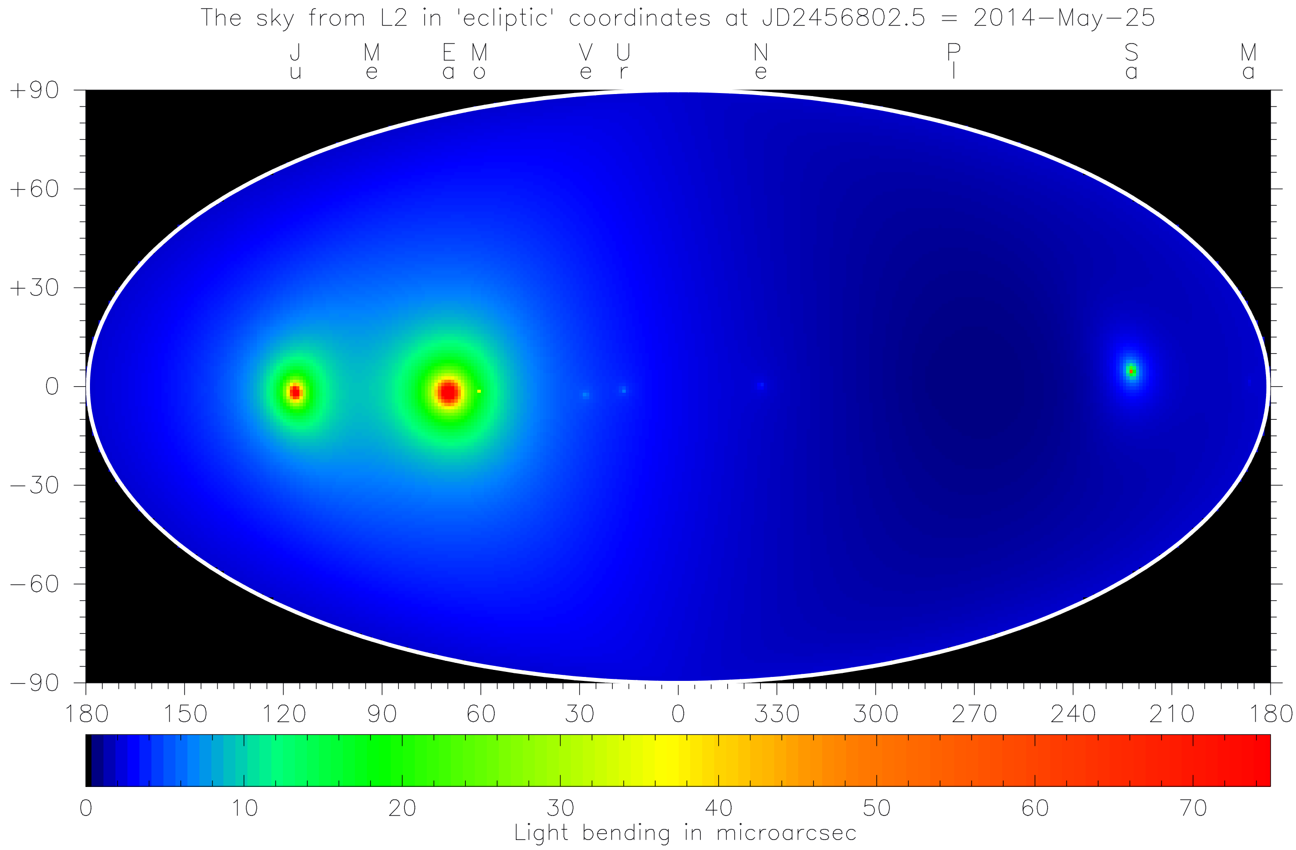

All-sky map (in ecliptic coordinates, for an L2-based observer) displaying the total amount of post-Newtonian light deflection due to all planets, and the Moon, at 25 May 2014 (two-letter object-name abbreviations appear above the top axis). The Sun has been suppressed because of its immense contribution, extending all over the sky, compared to the other bodies. The colour coding has been chosen such that significant light bending is predicted in all regions of the sky coloured different from blue.

Gaia will determine the positions, parallaxes, and proper motions for the brightest 1 billion objects in the sky. Expected astrometric accuracies are 20–25 μas at 15-th magnitude and a few μas for the brightest stars (up to 12-th magnitude). At these accuracy levels, it is vital to treat the Gaia data in a general-relativistic context. For example, photons detected by Gaia are bent during the last hours of their long journey, while traversing the solar system, under the influence of the gravitational fields of the Sun, planets, moons, asteroids, etc. The amount of this post-Newtonian light deflection depends on the mass of the perturbing object, its distance to the observer (Gaia), and the angular separation at which the photon passes the object. A well-known example is a light ray grazing the limb of the Sun: an observer on Earth will notice a deflection of 1.75 arcsec.

In the context of Gaia, correcting for solar-system light bending is critical: for a spherical perturbing body with a mean mass density ρ (in g cm^{-3}), the light deflection for a limb-grazing light ray is larger than δ (in μas) if its radius $r > \rho^{-1/2} \cdot \delta^{1/2} \cdot$ 624 km. Typically, $\rho \sim 1$ g cm^{-3} for objects in the solar system, so that Gaia's astrometric measurements will be 'affected' to a significant extent ($\delta \sim$ 1–10 μas) by all bodies with radii larger than $\sim$ 624 km. (For Jupiter and Saturn, the quadrupole contributions of their gravitational fields should also be taken into account.)

In principle, this translates for Gaia, observing from L2, to the Sun and all planets (including the Earth and Moon) and to a number of the larger moons (notably Io, Europa, Ganymede, Callisto, and Titan; light deflection in these cases, however, is only significant at angular separations smaller than a few arcseconds). In practice, however, due to the geometry of the scanning law which effectively creates a 45°-radius zone of avoidance on the sky centered on the Sun, the contributions from Mercury and the Moon, for example, can always be neglected. Minor bodies (e.g. main-belt asteroids and Kuiper-Belt objects) and smaller moons are unimportant. The Sun, on the other hand, contributes significantly to light bending even 180° away from its center.