Introduction

1. BY COMBINING CONTORUNING AND RAYSHEETING
   SIMULATION OF MICROLENSING LIGHTCURLS

2. The hybrid method

   The hybrid method described in terms of all (1993) and VI (1994) provide the
   images of the source area for a given noise level.

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within known, closed polygons. Rayshooting is then performed within all
the closed polygons, and the lightcurve is produced in the usual way.

3. Efficiency

The efficiency of the rayshooting part of the method compared to crude,
non-optimized rayshooting can be found by comparing the size of the areas
where rayshooting has to be performed. A target area in the source plane
with length $2l$, and height $2r_n$ gives an effective lightcurve length $L_c =
2l - 2r_n$, where $r_n$ is the source radius. The theoretical efficiency $\hat{f}$ can be
shown to be given by

$$\hat{f} \approx \begin{cases} 
(1 + \frac{10\sqrt{\kappa_*}}{r_n} + \frac{100\kappa_*}{r_n^2}) & \text{For } l \gg r_n \\
(1 + \frac{20\sqrt{\kappa_*}}{r_n} + \frac{100\kappa_*}{r_n^2}) & \text{For } l = r_n, L_c = 0.
\end{cases}$$

(1)

4. Discussion

The above arguments give a theoretical efficiency factor on the order of
$10^5$ for e.g. a snapshot of the source with $r_n = 0.01, l = r_n$ and $\kappa_* = 0.4$.
However, the most time-consuming task for the hybrid method is going to
be the contouring itself. For a snapshot like the example above, the
contouring amounts to about $10^5$ shots (Lewis et al., 1993). This must be
compared with the total number of shots necessary to get a specific signal
to noise ratio, generally about $10^3$ shots. The highest estimates of $\hat{f}$ thus
have to be lowered by roughly a factor of 100, depending on the specific
parameters $r_n, \kappa_*, \gamma$, and $l$.

Even so, the proposed hybrid method has the potential to be a very
efficient workhorse for producing accurate model lightcurves for small but
extended sources.

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References