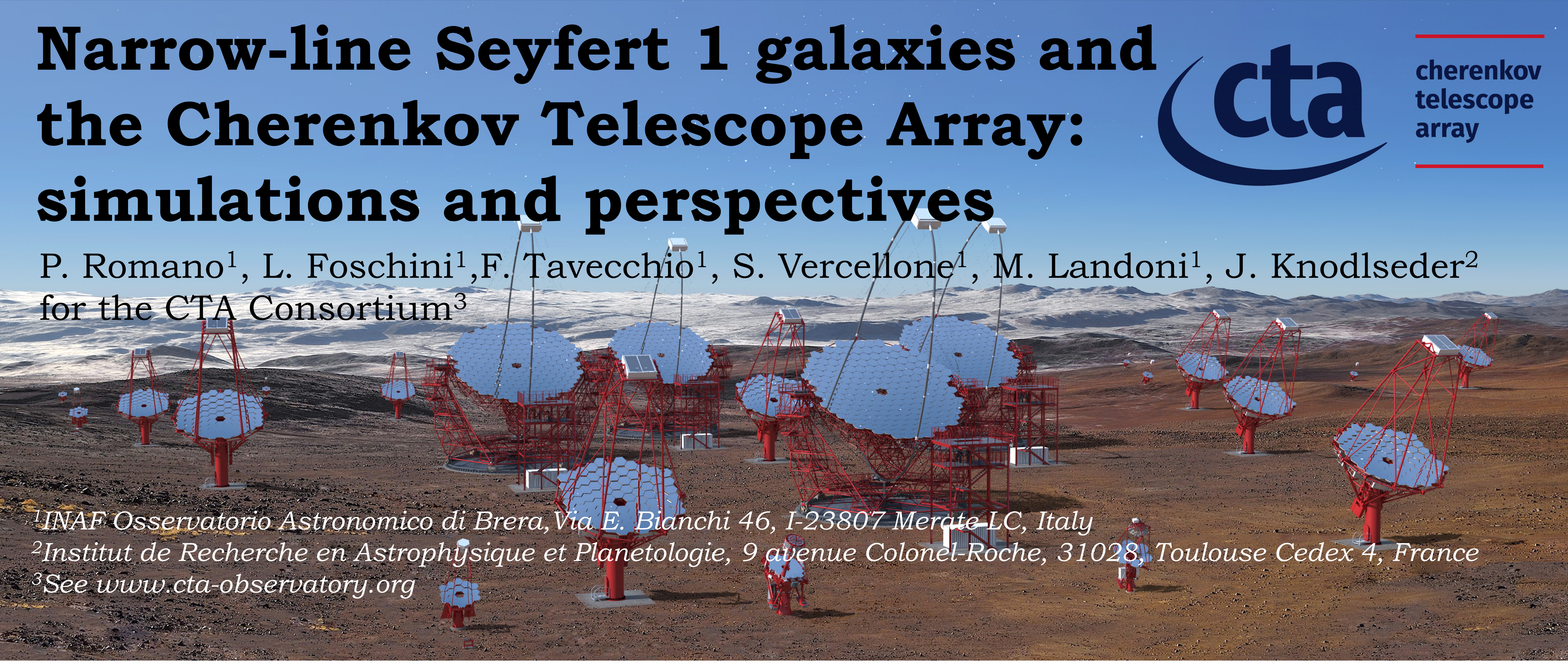

Narrow-line Seyfert 1 galaxies and the Cherenkov Telescope Array: simulations and perspectives

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cherenkov telescope array

ABSTRACT

In the last decade, narrow-line Seyfert 1 (NLS1) galaxies have been discovered to be gamma-ray emitting sources, with extreme properties of flux and spectral variability in the gamma-ray energy band. This points toward a jetted, blazar-like nature. These same properties, therefore, can be investigated with the the next-generation ground-based gamma-ray observatory, the Cherenkov Telescope Array (CTA), which will potentially be about two orders of magnitude more sensitive with respect to Fermi-LAT at the overlapping energy of 25 GeV for transients/flaring events (time-scales of ~1 day or shorter). We present the results of our simulations of all currently known gamma-ray emitting NLS1s, performed using the CTA public ctools software and the public instrument response files. We investigate their possible detection and spectral properties, taking into account both the effect of the extra-galactic background light in the propagation of gamma-rays and intrinsic absorption components.

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INTRODUCTION

Narrow-Line Seyfert 1 galaxies (NLS1s) are a subclass of active galactic nuclei (AGN) located at the lower end of the line-width distribution for the Seyfert 1 population. Gamma-ray emitting narrow-line Seyfert 1 (γ-NLS1) galaxies are thought to harbour relatively low-mass black holes (10^6-10^8 solar masses) accreting close to the Eddington limit. They show characteristics similar to those of blazars, such as flux and spectral variability in the gamma-ray energy band and radio properties which point toward the presence of a relativistic jet. These characteristics make them an intriguing class of sources to investigated with the Cherenkov Telescope Array (CTA), the next-generation ground-based γ-ray observatory.

METHODS

We performed simulations for the whole γ-NLS1 sample (20 sources, of which 2 are candidates) using CTOOLS (Knodlseder et al. 2016) through Amazon Web Services as described in Landoni et al. 2018.

RESULTS

We find (Romano et al. 2018) that the prospects for observations of γ-NLS1 with CTA are promising. In particular, the brightest sources of our sample,

- **SBS 0846+513 (Fig. 1),**
- **PMN J0948+0022 (Fig. 2), and**
- **PKS 1502+036**

can be detected during high/flaring states in 50 hr, the former two even in the case in which the emission occurs within the highly opaque central regions, which prevent γ-rays above few tens of GeV to escape. In this case the low-energy threshold of CTA will play a key role.

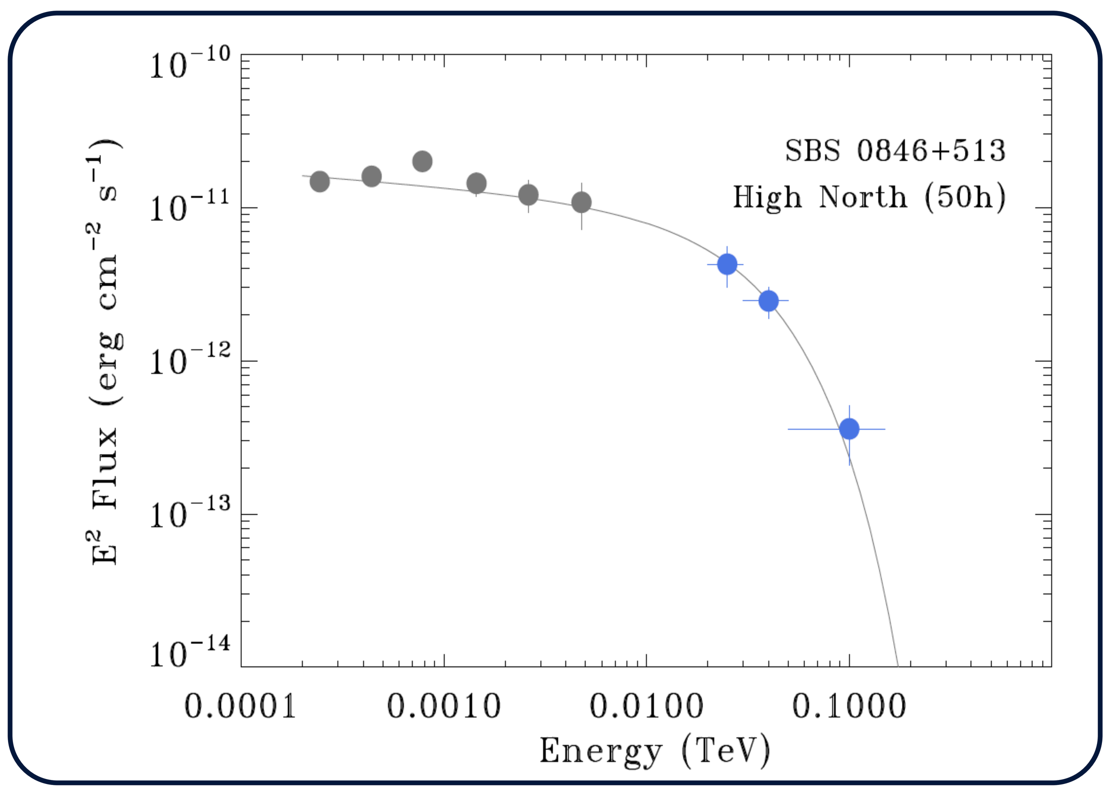

Fig. 1: SED of SBS 0846+513 in the high state. The grey line is the input model, the blue points the simulated fluxes for 50 hr of exposure. The grey points are from Paliya et al. (2016).

If, on the other hand, high-energy emission occurs outside the broad line region, we can detect the sources up to several hundreds of GeV (see Fig. 3, red points), depending on the intrinsic shape of the emitted spectrum.

Therefore, CTA observations will provide valuable information on the physical conditions and emission properties of their jets.

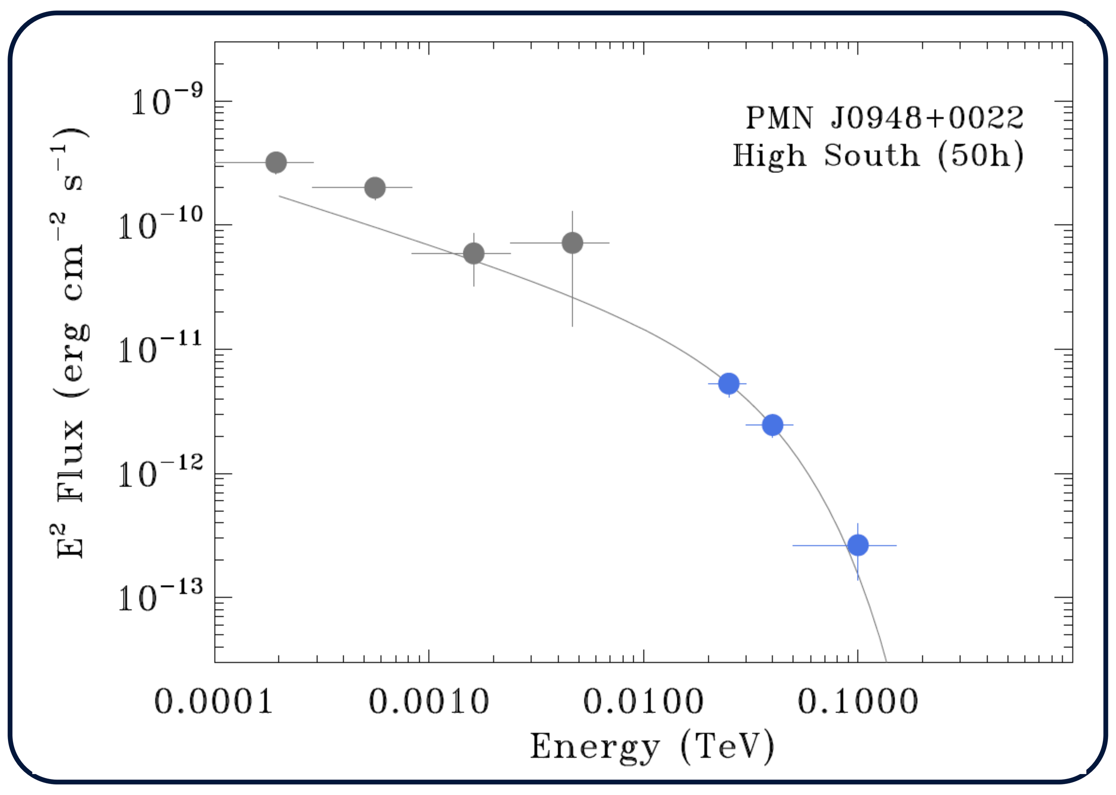

Fig. 2: SED of PMN J0948+0022 in the high state. The grey line is the input model, the blue points the simulated fluxes (50 hr exposure). The grey points are from Foschini et al. (2011) .

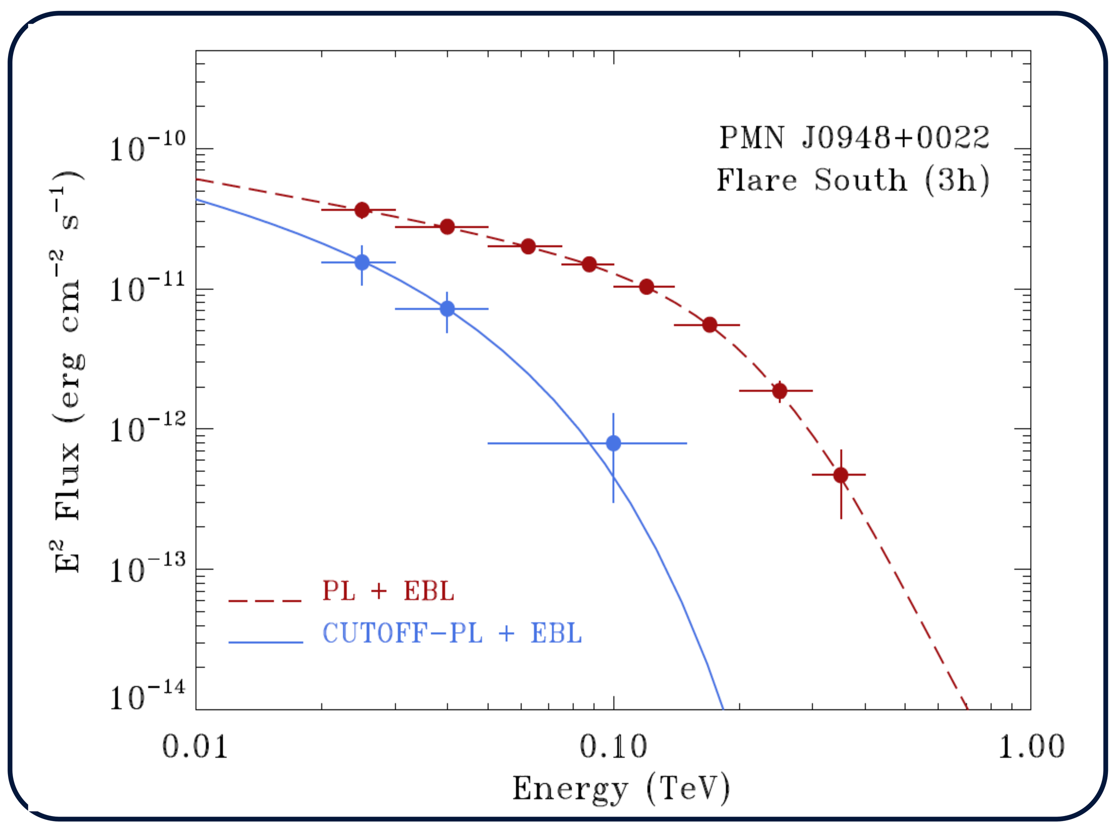

Fig. 3: SED of PMN J0948+0022 in flare (exposure of 3 hr). The blue line is the input model, the blue points the simulated fluxes. The red dashed line is the input model which does not include the cut-off due to internal absorption, the red points the simulated fluxes.

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