Contribution ID: **171** Type: **Poster**

Impact of the Einstein Telescope in Sardinia (Italy): Well-Being & Sustainability Indicators

One of the key requirements for achieving the expected sensitivity in detecting weak gravitational waves is to secure an area free from both natural and anthropogenic noise. For this reason, the proposed Italian site for the Einstein Telescope is located adjacent to the former Sos Enattos metalliferous mine in northeastern Sardinia (Province of Nuoro). Sardinia's unique tectonic setting—as a microplate separated from the Eurasian Plate—ensures exceptional seismic stability, characterized by extremely low local seismicity and a lack of active tectonic phenomena, along with ideal rock formations for underground facilities. Moreover, the rural area benefits from minimal human and industrial activity due to its low population density.

To evaluate the potential impact of the future gravitational wave detector, an in-depth territorial analysis of Sardinia was conducted. This study examined statistical indicators and territorial data to assess accessibility, economic well-being, productive structures, and environmental and landscape characteristics. The analysis was carried out at both regional and municipal levels—with particular focus on the municipalities involved in the detector's configuration—to provide a detailed overview of the local context, highlighting strengths and identifying potential challenges.

Economic and social well-being indicators were used to assess local quality of life and socio-economic conditions, complemented by an examination of demographic and economic dynamics—particularly development trends and population distribution. This was further enriched by evaluating local infrastructure and the availability of essential services, offering a comprehensive view of the region. Additionally, environmental and landscape contexts were explored to highlight the area's natural attributes and conservation status, while potential environmental risks such as pollution and extreme weather events were scrutinized. Finally, the criteria for environmental sustainability were considered, emphasizing the Einstein Telescope's potential to integrate harmoniously with its surroundings by minimizing negative impacts and promoting eco-friendly solutions.

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Session Classification: Poster Session