

# Observability of first galaxies with a generic FIR/sub-mm telescope

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**Abstract** / Luminous sources at high redshifts, such as the first galaxies, constitute promising targets for next-generation surveys as they provide unique tools to test models of early structure formation. We explore the possibility of detecting first galaxies with a generic far-infrared/sub-millimeter (FIR/sub-mm) telescope by applying an analytical model of primordial dust emission. As shown in previous works, galaxies at redshifts  $z > 7$  experience a strong negative K-correction in such a way that systems of similar masses are brighter at higher  $z$ . We evaluate the observability of model sources at different  $z > 7$  as a function of the observed survey area ( $\Delta\Omega$ ) and sensitivity ( $S$ ) of a generic instrument. Assuming  $\Delta\Omega \sim 10 \text{ deg}^2$  and a plausible  $S \sim 1 \mu\text{Jy}$  for a near future survey, we could assure the detection of at least one typical source with dust-to-metal ratio ( $D/M$ )  $\sim 5 \times 10^{-3}$  at  $z > 7$ . For  $S \gtrsim 1 \mu\text{Jy}$  and  $\Delta\Omega \lesssim 10 \text{ deg}^2$ , higher than typical  $D/M$  are required to detect at least one individual source at  $z > 7$ . Considering the strong dependence of the predicted FIR/sub-mm radiation on the nature of primordial dust, future FIR/sub-mm campaigns could play a crucial role in exploring the nature of the interstellar medium and star formation in the early universe.

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