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Physical Review Letters

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Evidence for the Associated Production of a Single Top Quark and a Photon in Proton - Proton Collisions at  $s = 13$  TeV (Article) [\(Open Access\)](#)Sirunyan, A.M.<sup>a</sup>, Tumasyan, A.<sup>a</sup>, Adam, W.<sup>b</sup>, Ambrogio, F.<sup>b</sup>, Asilar, E.<sup>b</sup>, Bergauer, T.<sup>b</sup>, Brandstetter, J.<sup>b</sup>, Dragicevic, M.<sup>b</sup>, Erö, J.<sup>b</sup>, Escalante Del Valle, A.<sup>b</sup>, Flechl, M.<sup>b</sup>, Frühwirth, R.<sup>b,ex</sup>, Ghete, V.M.<sup>b</sup>, Hrubec, J.<sup>b</sup>, Jeitler, M.<sup>b,ex</sup>, Krammer, N.<sup>b</sup>, Krätschmer, I.<sup>b</sup>, Liko, D.<sup>b</sup>, Madlener, T.<sup>b</sup>, Mikulec, I.<sup>b</sup>, Rad, N.<sup>b</sup>,[View additional authors](#) <sup>a</sup>Yerevan Physics Institute, Yerevan, Armenia<sup>b</sup>Institut für Hochenergiephysik, Wien, Austria<sup>c</sup>Institute for Nuclear Problems, Minsk, Belarus[View additional affiliations](#)

## Abstract

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The first evidence of events consistent with the production of a single top quark in association with a photon is reported. The analysis is based on proton - proton collisions at  $s = 13$  TeV and recorded by the CMS experiment in 2016, corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup>. Events are selected by requiring the presence of a muon ( $\mu$ ), a photon ( $\gamma$ ), an imbalance in transverse momentum from an undetected neutrino ( $\nu$ ), and at least two jets ( $j$ ) of which exactly one is identified as associated with the hadronization of a b quark. A multivariate discriminant based on topological and kinematic event properties is employed to separate signal from background processes. An excess above the background-only hypothesis is observed, with a significance of 4.4 standard deviations. A fiducial cross section is measured for isolated photons with transverse momentum greater than 25 GeV in the central region of the detector. The measured product of the cross section and branching fraction is  $\sigma(pp \rightarrow t\gamma)B(t \rightarrow \mu\nu b) = 115 \pm 17(\text{stat}) \pm 30(\text{syst})$  fb, which is consistent with the standard model prediction. © 2018 CERN, for the CMS Collaboration.

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