

# SAPPHIRE, a cost-effective photon-photon collider to study the Higgs boson

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The option of a photon collider as a Higgs factory will be discussed.

The relatively low mass of the Higgs boson candidate stimulated the studies of a dedicated facility, decoupled from a high energy Linear Collider: the s-channel production requires indeed much smaller center of mass energy than for the  $e^+e^-$  case and consequently a relatively compact machine design and reduced cost. SAPPHIRE is an example of a photon collider based on a pair of 10 GeV recirculating Linacs similar in design to those proposed for the LHeC; we will present parameters for the  $e^-$  beams and the laser back-scattering system that will allow a peak luminosity of  $0.36 \times 10^{34}/\text{cm}^2/\text{s}$  at  $E_{\text{CM}}(\gamma\gamma) \sim 125$  GeV.

Such luminosity will lead to a total number of signal events per year ( $O(10^4)$ ) comparable to the one expected at the ILC. The physics program is complementary to the  $e^+e^-$  one and includes the analysis of several decay modes, the measurement of the mass, the CP quantum numbers and total width (relying on branching ratios determined somewhere else). We will also stress the importance of the possible synergy with other fields such as laser physics or nuclear physics that can profit from a very intense and brilliant photon beam, e.g. extending/complementing the programme of facilities like ELI-NP.

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