

# Search for Beyond-Standard-Model (BSM) Higgs boson decay to $2\ell 2j$ with the ATLAS detector at the LHC

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The discovery of the Higgs boson opened new windows in the search for new physics phenomena beyond the Standard Model (SM). In the Standard Model (SM), the Higgs boson is unique: it has zero spin, no electric charge and no strong force interaction. Several BSM theories predict an extended Higgs sector, which motivates searches for neutral and charged Higgs bosons in addition to the Higgs boson already observed at 125 GeV. The presence of a hidden or dark sector of phenomena that relates either weakly or in a particular way to SM fields has theoretical as well as experimental support. Many extensions of SM use hidden or dark sector states based on the Higgs Portal, and thereby opening the Higgs portal as a discovery channel, hence proposing a specific candidate for Dark Matter (DM) in the universe. The contribution discusses the ongoing searches of possible exotic decays:  $H \rightarrow Z(Z_d)Z_d \rightarrow 2\ell 2j$  where  $Z_d$  is a dark vector boson, including additional scalar  $S$  ( $m_S \neq m_H$ ) that decays to  $2\ell 2j$  via two dark vector boson states  $Z_d$ . The search uses proton-proton collision data collected with the ATLAS detector at the LHC with an integrated luminosity of  $139 \text{ fb}^{-1}$  at the center-of-mass energy of 13 TeV.