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Complementarity of h -> eta eta -> 4b in the search of Higgs boson at the LHC

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The dominance of $h \to \eta\eta$ decay mode for the intermediate mass Higgs boson is highly motivated to solve the little hierarchy problem and to ease the tension with the precision data. However, the discovery modes for m_h $alt 150$ GeV, $h \to \gamma\gamma$ and $W/Zh \to (\ell\nu/\ell\bar{\ell})(b\bar{b})$, will be substantially affected. We show that $h \to \eta\eta \to 4b$ is complementary and we can use this decay mode to detect the intermediate Higgs boson at the LHC, via Wh and Zh production. Requiring at least one charged lepton and 4 B-tags in the final state, we can identify a clean Higgs boson signal for m_h $alt 150$ GeV with a high significance and with a full Higgs mass reconstruction. We use the next-to-minimal supersymmetric standard model and the simplest little Higgs model for illustration.

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