

The Higgs-radion: a viable candidate for the 125 GeV state

M.Geller^a

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(co-authors: S.Bar-Shalom^a and A. Soni^b)

a. Technion Institute of Technology, Israel

b. Theory Group, Brookhaven National Laboratory

The Goldberger-Wise (GW) Radion: stabilization of the warped ED

- ❖ RS models without radius stabilization- catastrophic for cosmology
- ❖ The GW mechanism: stabilization by a bulk singlet scalar field.
- ❖ **The Radion** = excitation of the radius; massive upon stabilization.

125 GeV State - GW Radion?

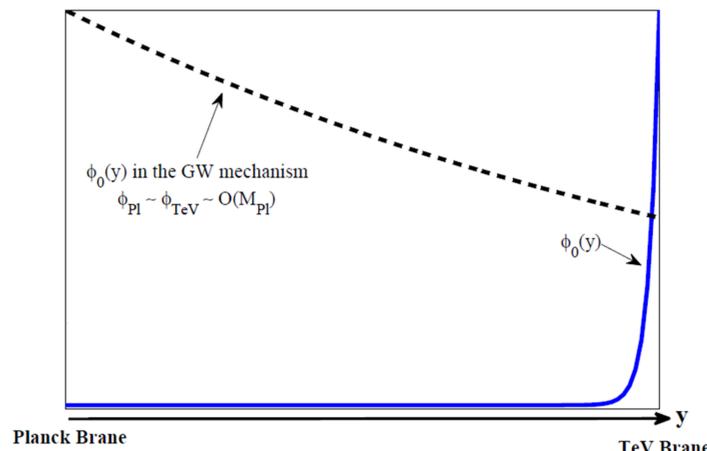
- ❖ The Radion has the same quantum number as the Higgs.
- ❖ It couples to the trace of the energy-momentum tensor: *Similar to Higgs couplings*
- ❖ It has tree level couplings to gluons and photons (via trace anomaly).
- ❖ However, all its couplings are suppressed by $\frac{v}{\Lambda_r}$ ($\Lambda_r \sim$ KK scale).
- ❖ **The GW radion cannot account for the 125 GeV LHC signals:**
 - ❖ Smaller production rates.
 - ❖ Skewed Branching ratios.



Our proposal- bulk Higgs stabilization

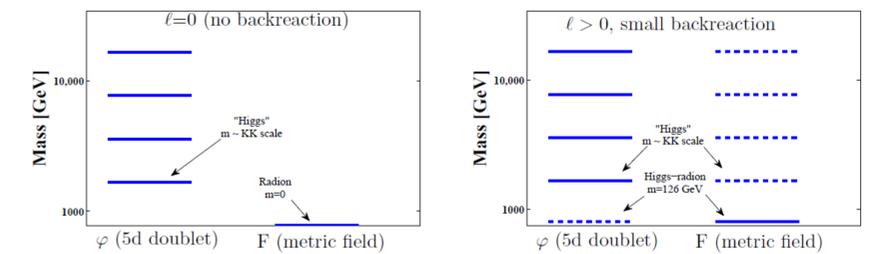
- ❖ A new approach: **stabilization with an $SU(2)$ bulk Higgs doublet.**
- ❖ An alternative to the GW mechanism: stabilization with a singlet VEV \rightarrow stabilization with a VEV of a doublet.
- ❖ The equations are similar, albeit, a potential problem:
 - To maintain the Higgs-Planck hierarchy: Higgs has to “live” close to the TeV brane.
 - Recall: the GW scalar profile is almost flat: $\phi_{UV} \sim \phi_{IR}$ leading to the hierarchy: $\frac{IR-scale}{Pl-scale} \sim e^{-4\frac{k^2}{m^2}}$ (m- bulk mass)
- ❖ Our alternative solution: the doublet VEV profile **is peaked to the IR** and gives:

$$\frac{IR-scale}{Pl-scale} \sim e^{-\left(2\sqrt{4+\frac{m^2}{k^2}}\right)^{-1}}$$



The Higgs-radion system

- ❖ The Einstein equations for the excitations are coupled: the same scalar modes in the Higgs field and in the metric.



- ❖ **The new “radion” mode is the lowest excitation both in the 5d Higgs field and in the metric-hence Higgs-radion.**
- ❖ Higgs-radion is naturally light: its mass is proportional to the Higgs VEV (the source of the back reaction).
- ❖ Stabilization conditions + $(m_{h,v})=(125,246)$ GeV leaves us with one free parameter Λ_r (KK scale)

Higgs- radion couplings and Higgs signals

- ❖ The Higgs-radion interactions stem from:
 - The 5d interaction of the Higgs field (Higgs-like)
 - The metric interaction (radion-like)
- ❖ **1 σ level agreement with the data for**

$$\Lambda_r = 3.0 \text{ TeV}$$
- ❖ **Predictions:**
 - At 95% CL, $4.48 \text{ TeV} < M_{KKG} < 5.44 \text{ TeV}$
 - Higgs precision: significant deviation from the SM, e.g.

$$\frac{\mu_{\gamma\gamma}^{ggF}}{\mu_{bb}^{ggF}} \simeq 2.5 \quad (\neq 1 \text{ in SM!})$$