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Defect ferromagnetism in ZnO and SnO₂ induced by non-magnetic dopants

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**Defect Ferromagnetism in ZnO and SnO₂ induced by
non-magnetic dopants**

Sadaf Akbar



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This work was performed at the Physics Department of the Quaid-i-Azam University, Islamabad, Pakistan and within “Top Research School” program of the Zernike Institute for Advanced Materials under the Bonus Incentive Scheme (BIS) of the Netherlands’ Ministry of Education, Science, and Culture.

Cover: Top images: different morphologies of $\text{SnO}_2:\text{Zn}^{2+}$ hierarchical nanostructures. Bottom images: (right) graph showing the changes in the local density of states, namely a splitting between spin up and spin down bands induced by a non-magnetic dopant, which lead to defect ferromagnetism in a metal oxide semiconductor; (left) schematic drawing of the structural relaxation of a non-magnetic dopant in SnO_2 . Light grey, gray, and black balls represent Sn, O, and non-magnetic atom, respectively. The Sn vacancy (V_{Sn}) is represented by a dashed circle. The arrow represents the movement of the non-magnetic atom towards V_{Sn} .

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 Magnificus Prof. E. Sterken and in
 accordance with
 the decision by the College of Deans.

This thesis will be defended in public on

Friday 24 February 2017 at 12.45 hours

by

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*Dedicated to my late father Muhammad Akbar, my mother G. Fatima
and my sister Tanzeela Akbar*

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