

武汉物数所理论交叉学术交流系列报告

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Silicene:

A functional material for future electronics?

Prof. Udo Schwingenschlögl

KAUST, Saudi Arabia

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About the speaker:

2001–2004 Scientific Employee, University of Augsburg, Germany

2004–2008 Secondary School Teacher, State of Bavaria, Germany

2008–2008 Visiting Professor, University of Brasília, Brazil

2008–2011 Assistant Professor, KAUST, Saudi Arabia

2009–2012 Program Chair “Materials Science & Engineering”,
KAUST, Saudi Arabia

2011–2014 Associate Professor, KAUST, Saudi Arabia

2012–2015 Associate Dean “Physical Science & Engineering”,
KAUST, Saudi Arabia

Since 2014 Professor, KAUST, Saudi Arabia



Abstract:

Silicene is the Si analogue of graphene with the same honeycomb structure and linear dispersions of the π and π^* bands at the K point of the Brillouin zone. It is predicted to realize a buckled structure, due to sp^2 - sp^3 hybridization, and is compatible with the current Si-based nano-electronics. Silicene yet has not been achieved by mechanical exfoliation, because of the sp^3 bonding, but can be deposited on metallic substrates such as Ag(111), Ir(111), and $ZrB_2(0001)$. Regrettably, strong interaction to these substrates destroys the Dirac physics. For this reason, semiconducting substrates including Si(111) and SiC(0001) have been explored theoretically whether they lead to a Dirac cone with reasonable band gap (which is essential for applications). However, surface passivation is inevitable for these and similar substrates, due to their dangling bonds. Layered materials such as $MgBr_2(0001)$, MoX_2 , and GaX_2 ($X = S, Se, \text{ and } Te$), on the other hand, preserve the characteristic electronic states of silicene and additionally simplify the preparation procedure as passivation is not required. The predicted effects of different substrates on silicene will be compared and evaluated with respect to technological requirements.

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