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TOTAL REFLECTION AND CANALIZED STATES IN A 3D QUANTUM MODEL OF THIN FILMS

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Phenomena of total reflection and total transmission are studied in the case of quantum particle 3D scattering on 2D periodic zero-range potentials. The general case is considered where the target is a "molecular monolayer" obtained by 2D periodic mapping of N different zero-range potential scattering centers. This is an infinite multicenter and multichannel scattering problem. It turns out that many of the global properties of reflection and transmission coefficients are determined by phenomena which occur at thresholds for opening of new scattering channels. We have performed detailed numerical studies for the cases when $N = 1$ (atomic monolayers) and $N = 2$ (planar and non-planar diatomic monolayers, that is atomic bilayers) on square and honeycomb lattices. In these cases many interesting predictions can be derived analytically. We have also addressed the problem of the quasi-2D localized states embedded in continuum, that is the band structures above the vacuum level.