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Encoding the structure of many-body localization with matrix product operators DAVID PEKKER, University of Pittsburgh, BRYAN K. CLARK, University of Illinois at Urbana Champaign — Anderson insulators are non-interacting disordered systems which have localized single particle eigenstates. The interacting analogue of Anderson insulators are the Many-Body Localized (MBL) phases. The natural language for representing the spectrum of the Anderson insulator is that of product states over the single-particle modes. We show that product states over Matrix Product Operators of small bond dimension is the corresponding natural language for describing the MBL phases. In this language all of the many-body eigenstates are encode by Matrix Product States (i.e. DMRG wave function) consisting of only two sets of low bond-dimension matrices per site: the G_i matrix corresponding to the local ground state on site i and the E_i matrix corresponding to the local excited state. All $2n$ eigenstates can be generated from all possible combinations of these matrices.

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