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*Equilibrium on  $C^*$ -algebras of product systems*

We generalize recent work of Afsar, Larsen and Neshveyev [ALN] describing KMS states of quasi-free dynamics on the Toeplitz  $C^*$ -algebras of product systems over quasi-lattice ordered semigroups. KMS states are parametrized by traces on the coefficient algebra that satisfy a positivity condition. This positivity condition can be reduced to a finite set of inequalities for a wide class of right LCM monoids that properly contains finite-type Artin monoids, answering a question raised in [ALN]. This allows us to exhibit a finite-type Artin monoid with a gap in its inverse temperature space. Our main technical result uses a certain tree recently constructed by Boyu Li to study dilations of contractive representations. For Noetherian right LCM monoids we also obtain a reduction of the positivity condition to inequalities arising from a minimal subset. This is joint work with Luca E. Gazdag and Nadia S. Larsen.