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**The Spectrum of Schrödinger Operators with Poisson Type Random Potential (joint work with Kazunori Ando, Akira Iwatsuka, and Fumihiko Nakano)**

(Abstract) We consider the Schrödinger operator with Poisson type random potential given by

$$H_\omega := -\triangle + \sum_{j=1}^{\infty} q_j(\omega) f(x - X_j(\omega)) \text{ on } L^2(\mathbf{R}^d),$$

where $\omega \in \Omega$, $(\Omega, \mathcal{F}, \mathbf{P})$ is a probability space, $f$ is a single-site potential such that $\|f\|_{l^1(L^p(\mathbf{R}^d))} = \sum_{n\in\mathbf{Z}^d} \|f\|_{L^p([-1/2,1/2)^d+n)} < \infty (p > p(d)$ with $p(d) = 2$ if $d \leq 3$, $= d/2$ if $d \geq 4)$, $\{q_j(\omega)\}_{j=1}^{\infty}$ is an i.i.d. such that $\mathbf{E}[|q_1(\omega)|^r] < \infty$ with $r > \max\{1, pd/(2(p - p(d))\}$, and $\{X_j(\omega)\}_{j=1}^{\infty}$ is the Poisson configulation with the intensity measure $\rho m(dx) (\rho > 0$, $m$ is the Lebesgue measure on $\mathbf{R}^d)$. $H_\omega$ describes electrons in amorphous materials where the atoms are distributed randomly.

We derive the spectrum which is deterministic almost surely. Apart from some exceptional cases, the spectrum is equal to $[0, \infty)$ if the single-site potential is non-negative, and is equal to $\mathbf{R}$ if the negative part of it does not vanish with positive probability, which is consistent with the naive observation. To prove that, we use the theory of admissible potential and the Weyl asymptotics. We give here the outline of the proof of our theorem. Along the theory developed by Kirsch and Martinelli, we consider the family of admissible potentials $\mathcal{A}$ which is composed of all the superposition of a finite number of translates of $f$. We show that the (non-random) spectral set $\Sigma$ is equal to the closure of the union of the spectrum of the Schrödinger operator with the admissible potential. Then, by the definition of addmissible potential, $\sigma_{\text{ess}}(-\triangle + W) = [0, \infty)$ for any addmissible potential $W$, so that the statements "$\Sigma = [0, \infty)$" in our theorem are easy to prove. To show "$\Sigma = \mathbf{R}$" in the other case, we aim to deduce a contradiction, supposing that there exists $b \in \Sigma^c$. Let $\mathcal{A}_n$ be the set of elements in $\mathcal{A}$ which are superposition of $n$-translates of $f$: $W(x) = \sum_{j=1}^{n} cf(x - u_j) \in \mathcal{A}_n$, $c \in \text{supp } \mathbf{P}_q$. Here $\mathbf{P}_q(E) = \mathbf{P}(\{\omega \in \Omega : q_1(\omega) \in E\})$ for any Borel set $E \subset \mathbf{R}$. The number of eigenvalues of $-\triangle + W$ less than $b$ is independent of $\{u_j\}_{j=1}^{n}$ by continuity. By taking each $u_j$ far apart each other, this number should be proportional to $n$. On the other hand, by taking $u_j = 0$ for all $j$, the Weyl asymptotics implies that this number should be proportional to $n^{\frac{d}{2}}$ in leading order, hence we arrive at a contradiction if $d \neq 2$.

The above strategy also works for $d = 2$ under some additional assumptions.