Overlaps How-To

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Bertsch and Robledo, arXiv:1108.5479

See also Avez and Bender, arXiv:1109.2078

$$\begin{pmatrix} \beta \\ \beta^+ \end{pmatrix} = \begin{pmatrix} U^+ & V^+ \\ V^T & U^T \end{pmatrix} \begin{pmatrix} c \\ c^+ \end{pmatrix} = \mathfrak{W}^+ \begin{pmatrix} c \\ c^+ \end{pmatrix} \tag{7.2}$$

$$\mathfrak{W} = \begin{pmatrix} D & 0 \\ 0 & D^* \end{pmatrix} \begin{pmatrix} \bar{U} & \bar{V} \\ \bar{V} & \bar{U} \end{pmatrix} \begin{pmatrix} C & 0 \\ 0 & C^* \end{pmatrix} \tag{7.7}$$

$$U = D\bar{U}C, \qquad V = D^*\bar{V}C. \tag{7.8}$$

$$|w\rangle = \prod_{\alpha}^{n} (u_\alpha + v_\alpha c_\alpha^\dagger c_{\bar{\alpha}}^\dagger)|\rangle. \tag{4}$$

$$\mathcal{P}_{Ki} = \frac{d_K}{\Omega_0} \int d\Omega \, R_{ii}^K(\Omega) \mathcal{R}(\Omega).$$

$$\mathcal{R} c_i^\dagger \mathcal{R}^{-1} = \sum_j R_{ij} c_j^\dagger; \quad \mathcal{R} c_i \mathcal{R}^{-1} = \sum_j R_{ij}^* c_j$$

1. Another form of the HFB wave function
2. Example n=2
3. Formula is also applicable to k-quasiparticle states
4. Try it yourself: download program from the web

$$\langle w|\mathcal{R}|w\rangle = \frac{(-1)^n}{\prod_\alpha |v_\alpha|^2}\mathrm{pf}\begin{bmatrix} V^T U & V^T R^T V^* \\ -V^\dagger R^\dagger V & U^\dagger V^* \end{bmatrix}$$

$$|qw\rangle = c^{\dagger}_{1/2}\left(u + vc^{\dagger}_{5/2}c^{\dagger}_{-5/2}\right)|\rangle \qquad (u, v) = (0.8, 0.6).$$

		$\langle NJJ_z\|qw\rangle^2$	
N	J	analytic	numerical
1	3/2	0	0.00000
1	5/2	$u^2 = 0.64$	0.64000
3	1/2	0	0.00000
3	3/2	$v^2/7 \approx 0.05143$	0.05143
3	5/2	$v^2/2 = 0.18$	0.18000
3	7/2	0	0.00000
3	9/2	$5v^2/14 \approx 0.12857$	0.12857

```
$python nzj_project.py
4 1 5 1
   N      J    olp
   1    0  3  0.000000 0.000000
   1    0  5  0.640000 0.000000
   3    0  3  0.051429 0.000000
   3    0  5  0.180000 0.000000
   3    0  7  -0.000000 0.000000
   3    0  9  0.128572 0.000000
$
```