Eigenspace of $\mathbf{L}_1$ spans Hodge subspaces

- **Nonzero** Eigenspace of up Laplacian spans the curl space

Simplicial Fourier transform

Frequency — eigenvalues

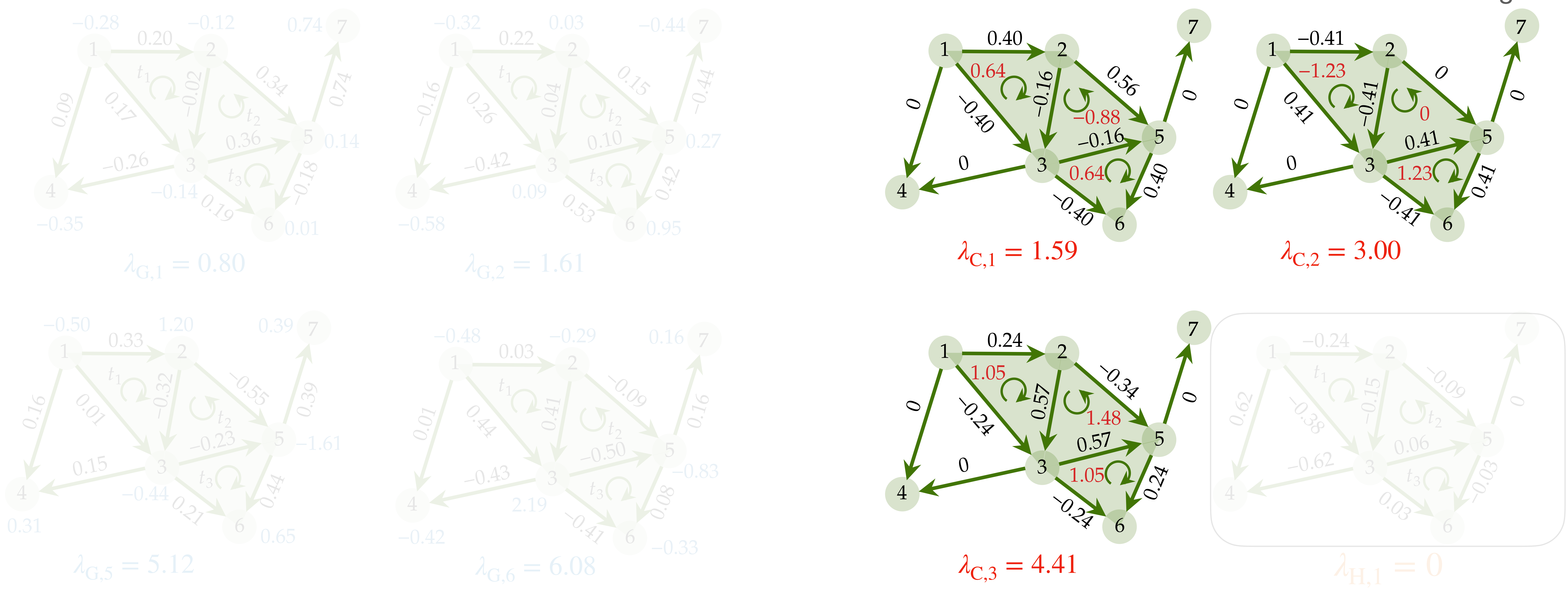
Fourier basis — eigenvectors

$\lambda_G = \|\mathbf{B}_1 \mathbf{u}_G\|_2^2$

$\lambda_C = \|\mathbf{B}_2^\top \mathbf{u}_C\|_2^2$

Curl eigenvector

Fourier basis reflecting rotational properties



EVD: $\mathbf{L}_1 = \mathbf{U}_1 \mathbf{\Lambda}_1 \mathbf{U}_1^\top$

$\mathbf{U}_1 = [\mathbf{U}_H \ \mathbf{U}_G \ \mathbf{U}_C]$

$\mathrm{span}(\mathbf{U}_C) = \mathrm{im}(\mathbf{B}_2)$

Eigenspace of $\mathbf{L}_1$ spans Hodge subspaces

- Kernel of Laplacian spans the harmonic space

Simplicial Fourier transform

Frequency — eigenvalues

Fourier basis — eigenvectors

EVD: $\mathbf{L}_1 = \mathbf{U}_1 \mathbf{\Lambda}_1 \mathbf{U}_1^\top$

$$\boxed{\begin{array}{c}\mathbf{U}_1 = [\mathbf{U}_H \ \mathbf{U}_G \ \mathbf{U}_C] \\ \mathrm{span}(\mathbf{U}_H) = \ker(\mathbf{L}_1)\end{array}}$$