

## On-chip source of polarized single photons with orbital angular momentum

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To obtain entanglement between orbital angular momentum (OAM) states and polarization states of single photons.

Color centers in nanodiamonds are sources of single photons at room temperature. We couple such single-photon emitters (SPEs) to surface plasmon polaritons (SPPs) supported on silver surfaces, by spin-coating nanodiamonds dissolved in deionized (DI) water. We further make dielectric Archimedean spiral gratings around the pre-characterized nanodiamonds containing SPEs.

A room-temperature on-chip integrated orbital angular momentum (OAM) source that emits well-collimated single photons carrying entangled polarization and OAM states is obtained. Two spatially separated entangled radiation channels with different polarization properties are generated. The OAM-encoded single photons are generated due to efficient outcoupling of diverging surface plasmon polaritons, excited with a deterministically positioned single-photon emitter, via Archimedean spiral gratings.

Our OAM single-photon source platform bridges the gap between conventional OAM manipulation and nonclassical light sources, enabling high-dimensional and large-scale photonic quantum systems for quantum information processing.

### References

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