

Sandro Sorella: Two of his **Gems**

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O1.1 - Stochastic "Reconfiguration"

Sandro Sorella

Phys. Rev. Lett. 80, 4558 (1998)

$$\exp(-\Delta_\tau \mathcal{H}) |\Psi(\theta)\rangle \simeq |\Psi(\theta')\rangle$$

Variational State

$$\frac{\theta' - \theta}{\Delta_\tau} = g^{-1}(\theta) F(\theta)$$

Quantum Geometric Tensor

$$g_{ij}(\theta) = -\frac{1}{2} \partial_i \partial_j |\langle \psi(\theta') | \psi(\theta) \rangle|^2 \Big|_{\theta'=\theta}$$
$$= \text{Re} \left\{ \langle \partial_i \psi | \partial_j \psi \rangle - \langle \partial_i \psi | \psi \rangle \langle \psi | \partial_j \psi \rangle \right\}$$

O1.2 - The infinite legacy of SR

The **Best* Optimizer** for Variational States

[used for many variational forms, from
Jastrow to Neural Network States]

Naturally Generalized to **Unitary Dynamics**

[t-VMC]

PRA 89, 031602 (2014)

Natural Gradient Descent in ML

[Classical Version, Contemporary]

Shun-Ichi Amari

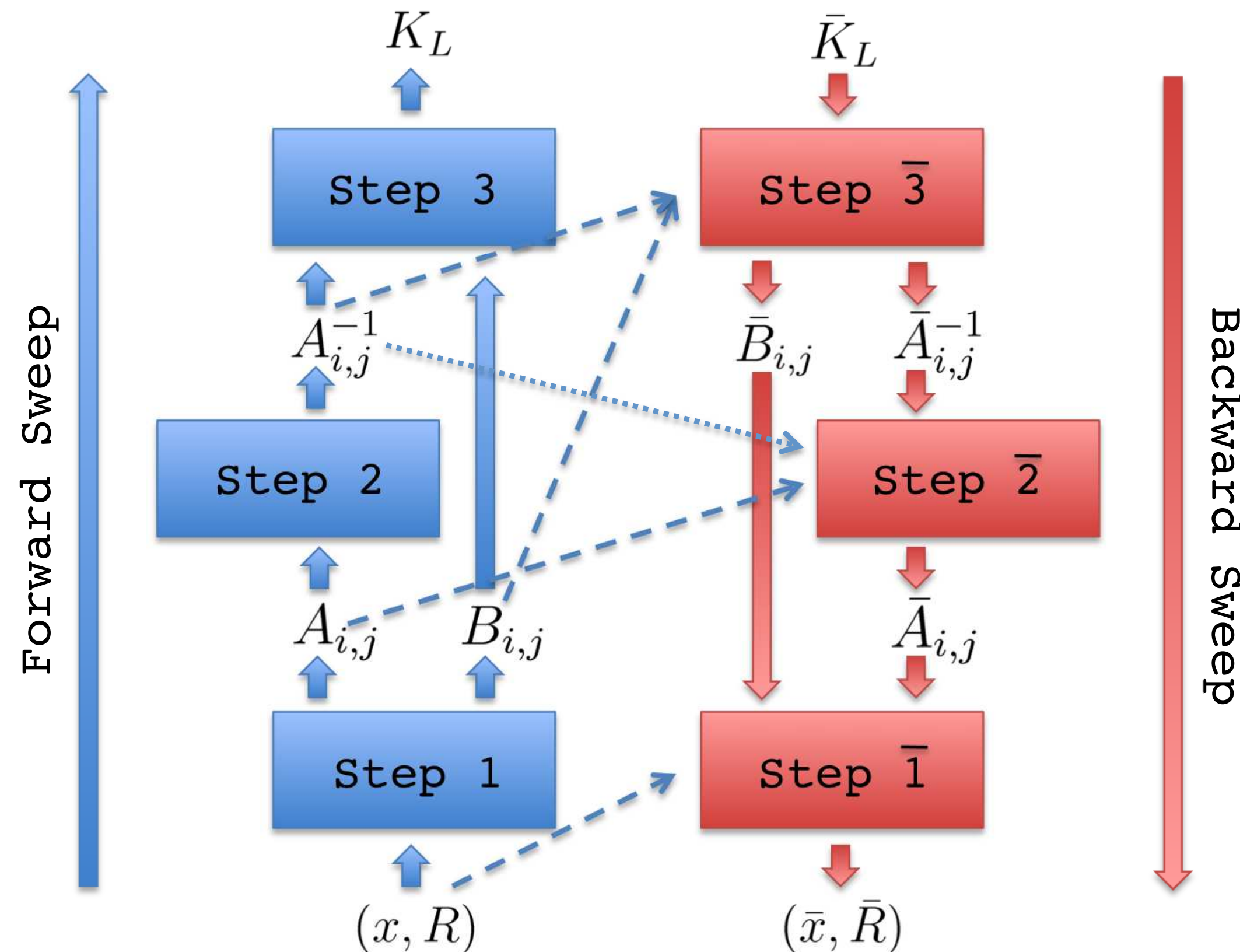
Neural Computation 10, 251
(1998)

Quantum Natural Gradient in **Quantum
Computing**

[used to optimize parameterized quantum
circuits]

O1.3 - Algorithmic Differentiation in VMC

Sandro Sorella, and Luca Capriotti
J. Chem. Phys. 133, 23411 (2010)



Algorithmic Differentiation is key to modern (scientific) computing

Sandro (and Luca) pioneers in this field almost 10 years ahead of others

"Gutta cavat lapidem"

A water drop hollows a stone (not by force, but drop by drop)

