

## INFORMATION ON THE KEYNOTE AT GMP-X 2026

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**Short Biography** Mohamed Boucetta is a Professor at Cadi-Ayyad University. His research interest are differential geometry and non associative algebras.

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Title: On the Hermitian structures of the sequence of tangent bundles of an affine manifold endowed with a Riemannian metric

ABSTRACT. Let  $(M, \nabla, \langle \cdot, \cdot \rangle)$  be a manifold endowed with a flat torsionless connection  $\nabla$  and a Riemannian metric  $\langle \cdot, \cdot \rangle$  and  $(T^k M)_{k \geq 1}$  the sequence of tangent bundles given by  $T^k M = T(T^{k-1} M)$  and  $T^1 M = TM$ . We show that, for any  $k \geq 1$ ,  $T^k M$  carries a Hermitian structure  $(J_k, g_k)$  and a flat torsionless connection  $\nabla^k$  and when  $M$  is a Lie group and  $(\nabla, \langle \cdot, \cdot \rangle)$  are left invariant there is a Lie group structure on each  $T^k M$  such that  $(J_k, g_k, \nabla^k)$  are left invariant. It is well-known that  $(TM, J_1, g_1)$  is Kähler if and only if  $\langle \cdot, \cdot \rangle$  is Hessian, i.e, in each system of affine coordinates  $(x_1, \dots, x_n)$ ,  $\langle \partial_{x_i}, \partial_{x_j} \rangle = \frac{\partial^2 \phi}{\partial x_i \partial x_j}$ . Having in mind many generalizations of the Kähler condition introduced recently, we give the conditions on  $(\nabla, \langle \cdot, \cdot \rangle)$  so that  $(TM, J_1, g_1)$  is balanced, locally conformally balanced, locally conformally Kähler, pluriclosed, Gauduchon, Vaismann or Calabi-Yau with torsion. Moreover, we can control at the level of  $(\nabla, \langle \cdot, \cdot \rangle)$  the conditions insuring that some  $(T^k M, J_k, g_k)$  or all of them satisfy a generalized Kähler condition. For instance, we show that there are some classes of  $(M, \nabla, \langle \cdot, \cdot \rangle)$  such that, for any  $k \geq 1$ ,  $(T^k M, J_k, g_k)$  is balanced non-Kähler and Calabi-Yau with torsion. By carefully studying the geometry of  $(M, \nabla, \langle \cdot, \cdot \rangle)$ , we develop a powerful machinery to build a large classes of generalized Kähler manifolds.