Abstracts
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This is a list of papers by A. Török, accompanied by short descriptions. References to papers from the list are enclosed in square brackets.

Papers in Refereed Journals


In [1, 2, 3] we show that if two Riemannian (Kähler) manifolds have the same spectrum of the Laplacian on p-forms and their (necessarily equal) dimension is in a p-dependent range, then one has constant (holomorphic) sectional curvature if and only if so does the other. In particular, for these dimensions, one can characterize the sphere $S^n$, respectively the complex projective space $P^n$($\mathbb{C}$), by the spectrum of its p-Laplacian. For most of the remaining dimensions, the p-spectrum characterizes $S^n$ and $P^n$($\mathbb{C}$) among Einstein manifolds. We use the method of S. Tanno.


We give a sufficient condition for an AF C*-algebra to have a unique trace. This condition implies that the group of finite dimensional automorphisms of the algebra is mixing with respect to the trace.


We exhibit new cases when the group of automorphisms of a free product of groups, Aut($\ast_{i=1}^n A_i$), ($2 \leq n < \infty$) can be embedded into the group of automorphisms of a free non-abelian group.


Using the results of the previous paper, [5], we exhibit a new class of discrete groups whose reduced C*-algebra is simple with unique trace, namely those groups which contain as a normal subgroup with trivial centralizer a free product of groups different from $\mathbb{Z}/2\mathbb{Z} * \mathbb{Z}/2\mathbb{Z}$. This generalizes a result of C. A. Akemann and T. Y. Lee.

We produce examples of maximal abelian subalgebras of the von Neumann algebra of a free non-abelian group and show that some of these are singular (i.e., the only unitaries that normalize the subalgebra are those contained in it). We generalize a result of F. Rădulescu.


We prove that the action $\rho_0 : \text{SL}(n, \mathbb{Z}) \to \text{Diff}(\mathbb{T}^n \times \mathbb{T}^d)$ given by $\rho_0(A)(x, y) = (Ax, y)$ is deformation rigid for $n \geq 3$ and any $d$. The main steps are the extension of a theorem of Livsic to Diff-valued cocycles, a non-abelian generalization of the Anosov Closing Lemma and a variant of the Hirsch–Pugh–Shub structural stability theorem for partially hyperbolic diffeomorphisms.


We consider cohomologically trivial cocycles over an Anosov action. The cocycles can take values in either linear Lie or diffeomorphism groups. We show that if the cocycle is $C^k$ then the transfer map is $C^{k-\epsilon}$.


We obtain results about the regularity of the transfer map between two cocycles over an Anosov system, with values in either a diffeomorphism or a linear Lie group. We also explain how certain examples of de la Llave show that our results are essentially optimal. This improves the results of the previous paper, [9], but the method is considerably simpler.


We develop a new technique for calculating the first cohomology of certain classes of actions of higher–rank abelian groups ($\mathbb{Z}^k$ and $\mathbb{R}^k$, $k \geq 2$) with values in a linear Lie group. In this paper we consider the discrete–time case. Our results apply to cocycles of different regularity, from Hölder to smooth and real–analytic. The main conclusion is that the corresponding cohomology trivializes, i.e. that any cocycle from a given class is cohomologous to a constant cocycle. The principal novel feature of our method is its geometric character; no global information about the action based on harmonic analysis is used.

The actions introduced in this paper are called “totally non-symplectic”, (TNS).

We prove certain rigidity properties of higher–rank abelian product actions of the type 
\[ \alpha \times \text{Id}_N : \mathbb{Z}^n \to \text{Diff}(M \times N), \]
where \( \alpha \) is (TNS) (i.e., is hyperbolic and has some special 
structure of its stable distributions). Together with a result about product actions of 
property (T) groups, this implies the local rigidity of higher rank lattice actions of the 
form \( \alpha \times \text{Id}_T : \Gamma \to \text{Diff}(M \times T) \), provided \( \alpha \) has some rigidity properties itself, and 
contains a (TNS) subaction. In particular, the action \( \rho_0 \) of [8] is locally rigid for \( n \geq 3 \) 
and \( d = 1 \).

13. V. Nițică and A. Török. An open dense set of stably ergodic diffeomorphisms in a 

One consequence of our results is the following. Let \( f := A \times \text{Id}_T \in \text{Diff}(M \times T) \), 
where \( A \in \text{Diff}_\nu(M) \) is a hyperbolic diffeomorphism on the compact manifold \( M \) that 
preserves the smooth probability measure \( \nu \). Denote by \( \lambda \) the Lebesgue measure on \( T \), 
and let \( \mu = \nu \times \lambda \) be the product measure on \( M \times T \). We show that in the space of 
measure preserving diffeomorphisms, \( f \) has a \( C^2 \)-neighborhood that contains an open 
dens set of stably ergodic diffeomorphisms.

Namely, we show that in a neighborhood of \( A \times \text{Id}_T \) stable accessibility is dense, and 
then use a result of C. Pugh and M. Shub.

and approximation by Brownian motion for compact Lie group extensions, to appear 
in *Ergodic Theory and Dynamical Systems*, 29 pages.

Hölder continuous observations on hyperbolic basic sets satisfy strong statistical prop-
erties such as exponential decay of correlations, central limit theorems and invariance 
principles (approximation by Brownian motion).

Using an equivariant version of the Ruelle transfer operator studied by Parry & Polli-
cott, we obtain similar results for equivariant observations on compact group extensions 
of hyperbolic basic sets.

15. I. Melbourne and A. Török. Central Limit Theorems and Invariance Principles for 

We give a general method for deducing statistical limit laws in situations where rapid 
decay of correlations has been established. In particular, using recent results of Dol-
gopyat, we prove that many classical limit theorems of probability theory, such as the 
central limit theorem, the law of the iterated logarithm, and approximation by Brown-
ian motion (almost sure invariance principle), are typically valid for time-one maps 
of hyperbolic flows.

16. A. Török. Rigidity of partially hyperbolic actions of property (T) groups, *Discrete and 

Our main result shows that for some partially hyperbolic actions of property (T) groups 
the joint integrability of the stable and unstable foliations is stable under \( C^2 \)-small 
volume-preserving perturbations. One consequence is the following:
Assume $\Gamma$ is an irreducible lattice in a semi-simple Lie group with all factors of $\mathbb{R}$-rank at least two. If $\alpha$ is an algebraic Anosov action of $\Gamma$ on a nilmanifold $M$, then $\alpha \times \text{Id}_{S^1}$ is $C^{2,K}$-locally rigid in $\text{Diff}_\mu(M \times S^1)$, where $\nu$ is the natural volume preserved by $\alpha$ and $\mu = \nu \times \text{Lebesgue}$.


We study extensions of TNS actions (i.e. hyperbolic and with a special structure of the stable distributions) by compact connected Lie groups. We show that up to a constant, there are only finitely many cohomology classes. We also show the existence of cocycles over TNS actions that are not cohomologous to constant cocycles. This is in contrast to earlier results, showing that real valued cocycles, or small Lie group valued cocycles, over TNS actions are cohomologous to constants.


We study steady-state bifurcations in one class of models of the primary visual cortex V1, under the assumption that the lateral coupling between hypercolumns is almost isotropic. Beside the pattern types found earlier by Ermentrout and Cowan, respectively Bressloff, Cowan, Golubitsky, Thomas and Wiener, we obtain two types of time-periodic states, which bear similarity to experimental observations: rotating structures such as spirals, and states that appear to rush into (or out from) a tunnel with its hole in the center of the visual field. Although it is known that branches of time-periodic states can emanate from steady-state bifurcations in systems with symmetry, this model provides the first examples of this phenomena in a specific class of models.

Papers in Conference Proceedings (Refereed)


We survey results concerning Lie-group and diffeomorphism-group valued cocycles over Anosov actions. We are mainly interested in abelian actions ($\mathbb{Z}$ or $\mathbb{Z}^k$), but non-abelian actions are also considered. We discuss: classification of cocycles up to cohomology, regularity of the transfer map, applications to rigidity of higher rank lattice actions.

Submitted Papers


In dynamical systems theory, a standard method for passing from discrete time to continuous time is to construct the suspension flow under a roof function. In this paper, we give a simple proof that statistical laws, such as the central limit theorem and almost sure invariance principle, for the underlying discrete time system are inherited by the
suspension flow. As a consequence, we recover results of Ratner (1973) and Denker and Philipp (1984) for Axiom A flows, and we obtain new results on nonuniformly and partially hyperbolic flows.


We obtain sharp results for the genericity and stability of transitivity, ergodicity and mixing for compact connected Lie group extensions over a hyperbolic basic set of a $C^s$ diffeomorphism, $s \geq 2$. In contrast to previous work, our results hold for general hyperbolic basic sets and are valid in the $C^r$ topology for all $r \in (0, s]$ (except that $C^1$ is replaced by Lipschitz). In particular, when $2 \leq r \leq s$, we show that there is a $C^2$ open and $C^r$ dense subset of $C^r$ extensions that are ergodic. We obtain similar results on stable transitivity for (non-compact) $\mathbb{R}^m$-extensions, thereby generalizing a result of Niteică & Pollicott, and on stable mixing for suspension flows. Furthermore, we prove analogues of these results where ergodicity, etc, is stable with respect to perturbations also of the underlying hyperbolic diffeomorphism. Finally, we use the results on suspension flows to prove that a hyperbolic basic set for a smooth flow is generically stably mixing.